

**Beaverhead County**

Baldy Mountain	Garrett Hill	PA # 01-092
Bannack	Apex Millsite	PA # 01-006
	Gold Leaf/Priscilla	PA # 01-031
Birch Creek	Indian Queen	PA # 01-034
Elkhorn-South	Old Elkhorn	PA # 01-169
Ermont	Ermont Mill & Mines	PA # 01-005
Hecla	Silver King	PA # 01-094
	Lower Cleve	PA # 01-143
	Trapper	PA # 01-144
Lemhi Pass	South Frying Pan	PA # 01-211
	Last Chance No. 1	PA # 01-216
	Last Chance No. 2	PA # 01-220
Lost Creek	Tungsten Millsite	PA # 01-170
Wisdom	Clara	PA # 01-262
	Martin	PA # 01-270

**Broadwater County**

Confederate	Miller Mountain	PA # 04-138
	Hummingbird	PA # 04-144
Hellgate	Argo	PA # 04-015
Indian Creek	Park (Marietta)	PA # 04-012
	St. Louis	PA # 04-013
	Diamond Hill	PA # 04-020
Radersburg	Ohio	PA # 04-009
	Keating Tailings	PA # 04-121
Winston	East Pacific	PA # 04-008
	Vosburg	PA # 04-014

REVISED

1/10

1/10











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MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: GARRETT HILL PA#: 01-092

Date: September 15, 1993 Time: 1545-1900

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Pierson, Pioneer

Visitors: None

Weather/Seasonality Observations: Cool (40° F); strong winds;  
mostly clear.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #4: Disturbed area  
on top of hill; #5: New exploration trench; #6: Mill building;  
#7: Tailings pond. Video Tape No. 6.

General Comments/Observations (not covered specifically in attached Inventory Forms):  
The disturbed area and containment sources appear to be relatively  
insignificant.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Minor  
grading, amendments, and reseeded.



Well logs within 1 mile radius; water rights 15 mi downstream (Attach MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Site lies near headwaters of the West Fork of Dyce Creek. Site is underlain by Paleozoic limestone intruded by quartz monzonite of the Mount Torrey batholith.

Mining/milling history, ore type/tenor, host rock, gangue: Mill was reported as a 150-ton mill constructed in 1955, but only produced a small amount of concentrate. Along contact zone between Paleozoic limestone and quartz monzonite intrusive, the limestone beds have been recrystallized and metamorphosed to form tactite zones, some of which contain Tungsten.

Mine Operation?

Shafts - Yes ☐, No ☒, #     , Comment                       
Adits - Yes ☐, No ☒, #     , Comment                       
Pits - Yes ☐, No ☒, #     , Comment                       
Placers - Yes ☐, No ☒, #     , Comment                       
Other - Yes ☒, No ☐, # 3, Comment Trenches; surface scrapings

Mill Operation? Yes ☒, No ☐. If yes answer the next three questions:

Period(s) of Operation: Unknown

Origin of Ore Milled - Custom Mill ☐ Dedicated Mill ☒; Number and names of mines that supplied mill feed: Appears to have been very small-scale and only operated briefly (small volume of tailings).

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting? Floatation



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): GARRETT HILL PA#: 01-092

Legal Description: T 6S ; R 12W ; Sec. 15 , NE1/4 NE1/4 1/4

County: BEAVERHEAD Mining District: BALD MOUNTAIN

Latitude: N 45° 19' 00" Longitude: W 113° 03' 00"

Primary Drainage Basin and Code: Dyce Creek/10020002

Secondary Drainage Basin: West Fork Dyce Creek

USGS Quadrangle map name(s): Polaris

Mine Type/Commodities: Hardrock/Tungsten

Activity Status: Active ☐ , Inactive/Exploration ☒ , Abandoned ☐ .

Ownership status: Known YX ☒ N ☐ ; private/public? Private

Owner, Agent, or Contact (include address and phone when available): Karl Truman,  
P.O. Box 2046, Idaho Falls, ID 83401.

Relationship to other mines/sites in the area/district: Unknown

Regulatory Status (Activity by other agencies)? Hardrock permits? ☐  
Past Reclamation Activities? N/A

General site features: Elevation 7880' , Slope 0°-5° ,  
Aspect Southeast

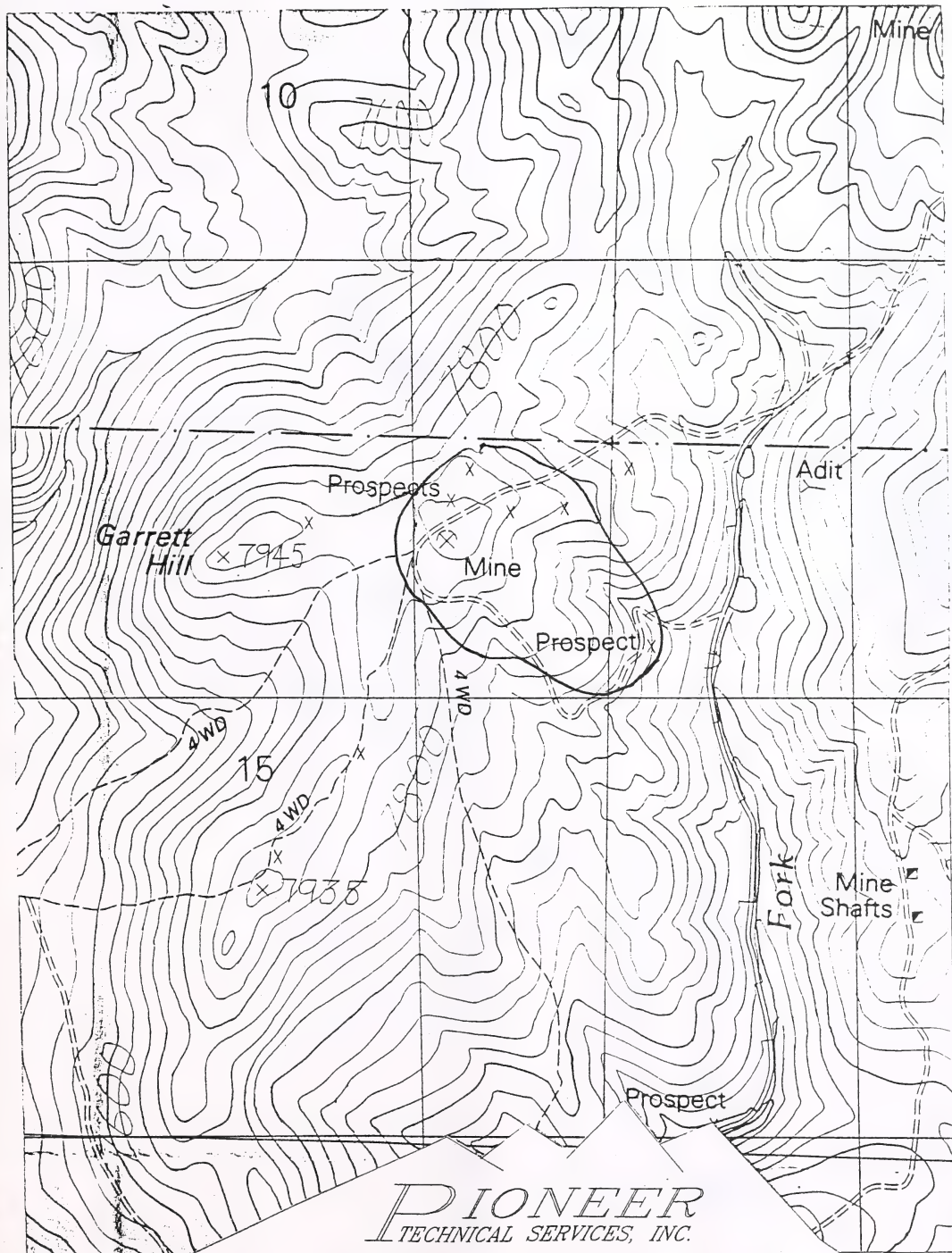
Land use: Mining ☒ , Recreational ☒ , Residential ☐ , Urban ☐ ,  
Agricultural ☐ , Other (Specify) ☐

Area of disturbed/unvegetated lands? 1-2.5 acres.  
Dimensions:

Predominant vegetation types: Sage, Idaho fescue

Access: roads - good ☐ , poor ☐ , 4wd ☒ , trail ☐ .  
Other logistical considerations (proximity to other sites).





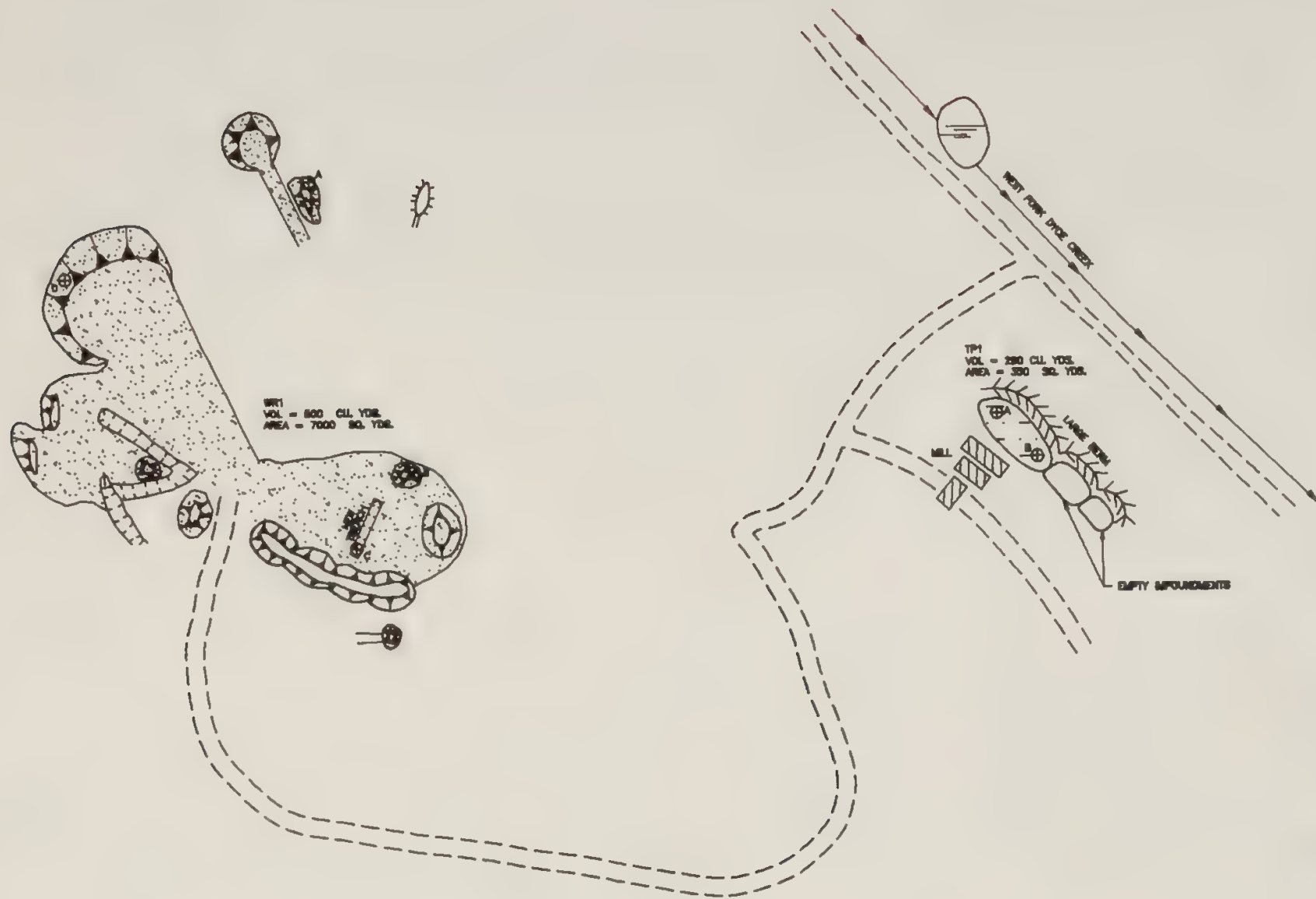
**PIONEER**  
TECHNICAL SERVICES, INC.

GARRETT HILL, P.A. NO. 01-092

T06S, R12W, SECTION 15

SCALE: 1" = 1000'





SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
=====	CULVERT	⊕	OPEN ADIT
*	LIGHT (LIGHT POLE)	⊗	COLLAPSED ADIT
⊙	UTILITY POLE	⊠	OPEN SHAFT
●	DECIDUOUS TREE	⊡	COLLAPSED SHAFT
⊙	CONIFEROUS TREE	○	EXCAVATION
—	WOOD FENCE	⊖	WASTE ROCK DUMP
—	WIRE FENCE	⊗	COLLAPSED TIMBERS
▨	BUILDING	—	RAILS
•	BARRIER POST	⊙	SOIL SAMPLE
>	DATE	⊕	XRF SAMPLE
- - -	EDGE OF ASPHALT	⊗	WATER SAMPLE
- - -	EDGE OF GRAVEL	⊕	GROUND AND SURFACE
▲	SLOPE DIRECTION	⊖	ORANGE
⬆	TAILINGS POND	⊙	WATER WELL
		⊖	PUMPED WATER
		⊖	VERIFIED WET LANDS

# LEGEND

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY  
GARRETT HILL MINE PA# 01-092  
BALD MOUNTAIN DISTRICT BEAVERHEAD COUNTY

**PIONEER**  
THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON  
DRAWN: DATE 12/10/93  
DESIGNED: JOB NO. 83-17  
APPROVED: SUR. F.B. NO.





## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay):  
Fine sand

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Tan material throughout with no stratification; average depth is 2.5 feet.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Dry

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Tailings impoundment is in excellent condition; berms are 100% intact and 100% vegetated.

Comments on potential for mitigation: Cap, if necessary.



SAMPLERS: Bullock, Pierson

<sup>a</sup> 0-Direct reading (Kelway Meter); S-Saturated Paste (Orion Meter)

Comments or deviations from SOPs: 01-092-WR-1 is composite of WR-1A through -1D. 01-092-TP-1 is composite of TP-1A and -1B.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Filled shafts: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Seeps/Springs: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Groundwater wells within 4 miles?: Yes X, No\_\_\_;  
Number of well logs: 12

Distance to nearest well used for drinking? Approx. 3.5 miles

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite\_\_\_, Probable\_\_\_, Possible\_\_\_, Unlikely X.

Very shallow and minimal disturbances in a very dry area.

Other observations/notes: N/A



## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): West Fork Dyce Creek

Dry streambeds: Yes     , No X, Name(s):     

Other surface water: Yes     , No X, Name(s)/Description:     

Waste materials within any floodplain: Yes     , No X Source ID(s):     

Approximate Flood frequency?      1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)? N/A

High Flow:     , Average Flow:     

Distance between waste source(s) and nearest surface water body (ft)?  
150 feet

Surface water draining onto or through waste sources: Yes     , No X,  
Describe:     

Surface water use within 15 miles downstream? (Drinking water supply, irrigation,  
residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Agricultural - irrigation and stock watering.

Observed erosional/sedimentation/stream turbidity problems? Yes     ,  
No X, Distance downstream (ft)?      Describe/explain (Note streambank  
stability and condition of streambank vegetation and any manmade structures or channel changes present):       
None observed during this investigation.

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

#### D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

##### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

##### General Potential for AMD Mitigation:

Area available for treatment (acres)? None

Wetlands present: Yes X, No   , Describe: Wetlands are present in Dyce Creek downstream of mine area.

Carbonate rocks/soils: Yes   , No X, Describe: No carbonate material observed, although limestone is described as host rock in the area.

#### E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10   ; 10-30 X; 30-100   ; 100-300   ; 300-1,000   ; 1,000-3,000   ; 3,000-10,000   ; 10,000 or greater   ; Comments   

Nearest residence(ft or miles)? Approx. 3.5 miles

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



SAMPLERS: Bullock, Pierson

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe: \_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments None

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: \_\_\_\_\_  
Camping and fishing in small pond on Dyce Creek, upstream from the mill.

Accessibility - Fences, warning signs, closed roads? Unrestricted

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment_____
Wilderness Area -	Yes____, No <u>X</u> , Comment_____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment_____
Bat Habitat -	Yes____, No <u>X</u> , Comment_____

Primary Drainage\_\_\_\_; Secondary Drainage\_\_\_\_; No Information X:

Riparian Habitat Quality - High\_\_\_\_, Medium\_\_\_\_, Low\_\_\_\_  
Wetlands Frontage - High\_\_\_\_, Medium\_\_\_\_, Low\_\_\_\_  
Fisheries Habitat and Species Classification - \_\_\_\_\_  
Sport Fishery Classification - \_\_\_\_\_

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Hazardous structures: Yes X, No\_\_\_\_, Number 1, types and locations: \_\_\_\_\_  
Mill structure is unstable.

Unstable highwalls, pits, trenches, slopes: Yes X, No\_\_\_\_, Number 1,  
types and locations: Newer trench has vertical sidewalls, but is only  
3 to 4 feet deep.

Unstable waste piles, impoundments, undercut banks: Yes\_\_\_\_, No X,  
Number\_\_\_\_, types and locations: \_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain: \_\_\_\_\_

## Bibliography

MBMG, Mineral Industry File 90.0, Garrett Mine, Beaverhead County, Montana.

MBMG, Mines and Mineral Deposits (Except Fuels), Beaverhead County, Montana, Bulletin No. 85, Author Unknown, April 1972, pp. 68-69.

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Garrett Hill, Prepared by Northern Engineering and Testing, June 17, 1987.

USGS, Topographic Map, Polaris, Montana, 7 1/2 minute Quadrangle, 1988.





LABORATORY ANALYTICAL DATA

GARRETT HILL  
PA NO. 01-092



Garrett Hill PA# 01-092  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 09/15/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
01-092-TP-1	17.2	11.7	0.7 U	2.85	23.7	456	31800	0.027 U	556 J	6.73	4.92 U	4.74 UJ	21	NR
01-092-WR-1	15.1	25.6	0.9 U	4.1	2.97	325	10500	0.026 U	450 J	6.8	6.27 U	6.05 UJ	52.5	NR
BACKGROUND	76	134	0.5 U	3	10	14.1	12100	0.024 J	482	10	23	7 J	59	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE %	NEUTRAL POTENT. t/1000	SULFUR ACID BASE POTENT. t/1000	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE t/1000	SULFUR ACID BASE POTENT. t/1000
01-092-TP-1	<0.01	0	107	107	<0.01	<0.01	0.01	0	107
01-092-TP-1DUP	<0.01	0	108	108	<0.01	<0.01	0.01	0	108
01-092-WR-1	<0.01	0	251	251	<0.01	<0.01	<0.01	0	251

LEGEND

TP1 - Composite of subsamples TP1A and 1B.  
WR1 - Composite of all samples WR1A through 1D.  
BACKGROUND - From the Ermont Mill (01-005-SS-1).  
TP1DUP - Duplicate of the 01-092-TP-1 sample.



XRF ANALYSIS RESULTS

GARRETT HILL  
PA NO. 01-092





XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-092-TP1-A			153706	312.22 *		1340.75 *	68814.4		238.127	149.781 *	96.2031 *	38.5032
01-092-TP1-B		1305.12 *	132938	502.453 *	175.834 *	1273.35	47396.6		418.111	73.0356 *	61.2185 *	98.1049
01-092-TP-1-COMP			150570	350.277 *	186.658 *	1638.13	58870.9		317.503	109.794 *	65.7719 *	72.3303
01-092-WR1-A		1611.96	136657	638.852		1610.27	31545		311.626	74.7827 *	62.5773 *	173.46
01-092-WR1-B			157284	408.001 *		738.295 *	26507.5		206.895	81.804 *	55.8622 *	107.313
01-092-WR1-C			106460		153.043 *	2361.43	47393.6		733.693	161.681	76.3212 *	
01-092-WR1-D			112379	823.57	176.649 *	1160.06	30749.3		306.577	107.856 *	51.4194 *	188.68
01-092-WR-1-COMP			133835	583.524	180.631 *	1254.65	35818.5		452.003	109.391 *	50.9495 *	110.118
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-092-TP1-A	31.5061	188.822	484.667		25.0758 *				127.459 *		8.23481 *	
01-092-TP1-B	23.9996		47.207		10.9809 *			22.8607 *				
01-092-TP-1-COMP	27.8583	68.6923 *	257.609								6.06509 *	
01-092-WR1-A	83.6647		6.75221 *					78.6732				
01-092-WR1-B	20.5442	51.3624	27.0868									
01-092-WR1-C	17.0909		8.68964 *									
01-092-WR1-D	35.9709		17.8414		15.4935 *			84.1799	142.653 *			
01-092-WR-1-COMP	42.5621		26.8442		17.2997 *				98.6375 *			

\* - Estimated Quantity

\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

GARRETT HILL  
P.A. NO. 01-092





# AIMSS SCORESHEET

SITE NAME:  
PA NUMBER:

GARRETT HILL  
01-092

LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.002
6		WELLS - 1 MI. x 2.5		0.0
7	GW - TARGETS	WELLS - 1 TO 4 MI		12
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	12.0
10		GROUNDWATER SCORE	LINES 4 x 5 x 9	5
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		0
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	400
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.005
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18	SW - TARGETS	WETLANDS		0
19		FISHERY		0
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	7
24		SURFACE WATER SCORE	LINES 14 x 15 x 23	14
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.000
29		POPULATION - 4 MILES		10
30		NEAREST RESIDENCE		0
31	AIR - TARGETS	WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	10
35		AIR PATHWAY SCORE	LINES 27 x 28 x 34	0
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		0
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	100
38		LIKELIHOOD SCORE	LINES 36 + 37C	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.000
40	DIRECT CONTACT	POPULATION - 1 MILE		0
41	TARGETS	NEAREST RESIDENCE		0
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 - 42	0
44		DIRECT CONTACT SCORE	LINES 38 x 39 x 43	0
45	TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE			0.00
	(LINES 10 + 24 + 35 + 44) / 100,000			

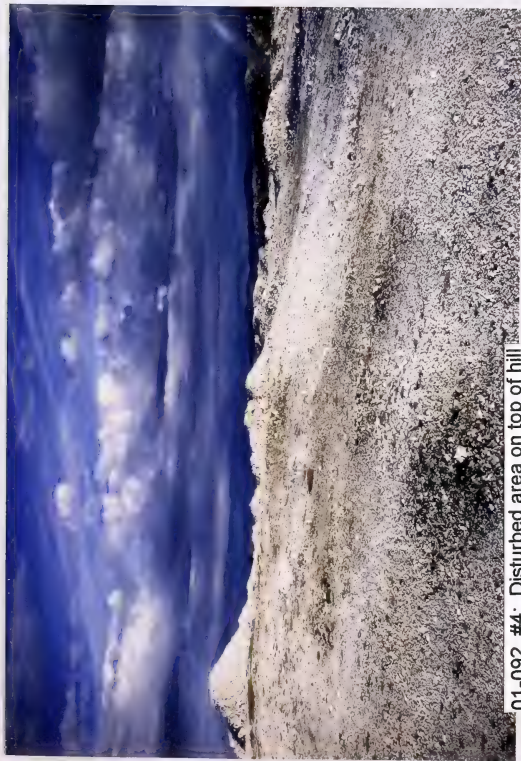
SITE NAME:  
PA NUMBER:

GARRETT HILL  
01-092

LINE  
NO.

**SITE SAFETY**

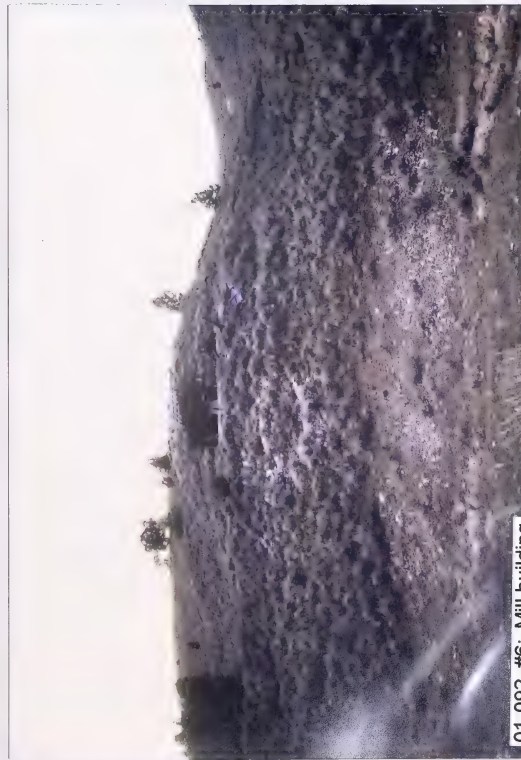
1	THREAT	ACCESSIBILITY		20
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	75
5		HAZ. STRUCTURES	40 EA.	40
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	115
9		POPULATION - 1 MILE		0
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 - 11	0
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>0.00</b>



01-092, #4: Disturbed area on top of hill



01-092, #5: New exploration trench



01-092, #6: Mill building



01-092, #7: Tailings pond











MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: APEX MILLSITE PA#: 01-006

Date: September 16, 1993 Time: 1900-2030

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Pierson, TD&H

Visitors: None

Weather/Seasonality Observations: Warm; calm; clear.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): No photos or video were taken.

General Comments/Observations (not covered specifically in attached Inventory Forms):  
No samples were taken due to the amount of CLP quality data the MDHES CECRA Program has collected during previous investigations and cleanup efforts.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Tailings were well characterized; no releases of contaminants to surface water or groundwater were detected. Grade, amend, and revegetate tailings.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): APEX MILLSITE PA#: 01-006

Legal Description: T 8S ;R 11W ;Sec. 6 , SW1/4 SE1/4NW 1/4

County: BEAVERHEAD Mining District: BANNACK

Latitude: N 45° 09' 48"      Longitude: W 112° 59' 50"

Primary Drainage Basin and Code: Grasshopper Creek/10020002

Secondary Drainage Basin: Grasshopper Creek

USGS Quadrangle map name(s): Bannack

Mine Type/Commodities: Millsite/Gold, Silver, Copper, Lead

Activity Status: Active ,Inactive/Exploration ,Abandoned X .

Ownership status: Known YX N ; private/public? Public

Owner, Agent, or Contact (Include address and phone when available): State of  
Montana

Relationship to other mines/sites in the area/district: Mill is  
situated below the Hendricks Lode.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? Runon control and tailings  
consolidation conducted by the MDHES/SHWB in 1989. The site is  
currently listed under CECRA Program.

General site features: Elevation 5800', Slope 0°-10°,  
Aspect North

Land use: Mining\_\_\_, Recreational X, Residential\_\_\_, Urban\_\_\_,  
Agricultural\_\_\_, Other(Specify) Bannack State Park

Area of disturbed/unvegetated lands? 3 acres.  
Dimensions:

Predominant vegetation types: Sagebrush, juniper, Douglas fir

Access: roads - good\_X,poor\_\_\_\_,4wd\_\_\_\_,trail\_\_\_\_.  
Other logistical considerations (proximity to other sites).

Well logs within 1 mile radius; water rights 15 mi downstream (Attach MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). The mill is located approx. 800 feet south of Grasshopper Creek.

Mining/milling history, ore type/tenor, host rock, gangue: The mill is associated with the Hendricks Mine, which was one of the earliest located in the district; however, not much development occurred until 1918 when a 5-stamp amalgamation mill was installed. A small ball mill, classifier, and two cyanide tanks were added in 1919. In 1920, a new 10-stamp mill was constructed. The new mill consisted of a ball mill, a classifier, two agitators, four thickeners, and six cyanide tanks with a capacity of 50 tons per day. Total recorded production from the Hendricks Mine was 23,594 tons of ore which yielded 5,299 oz. gold, 4,979 oz. silver, 296 lbs. copper, and 251 lbs. lead.

Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 1, Comment Open, but gated  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

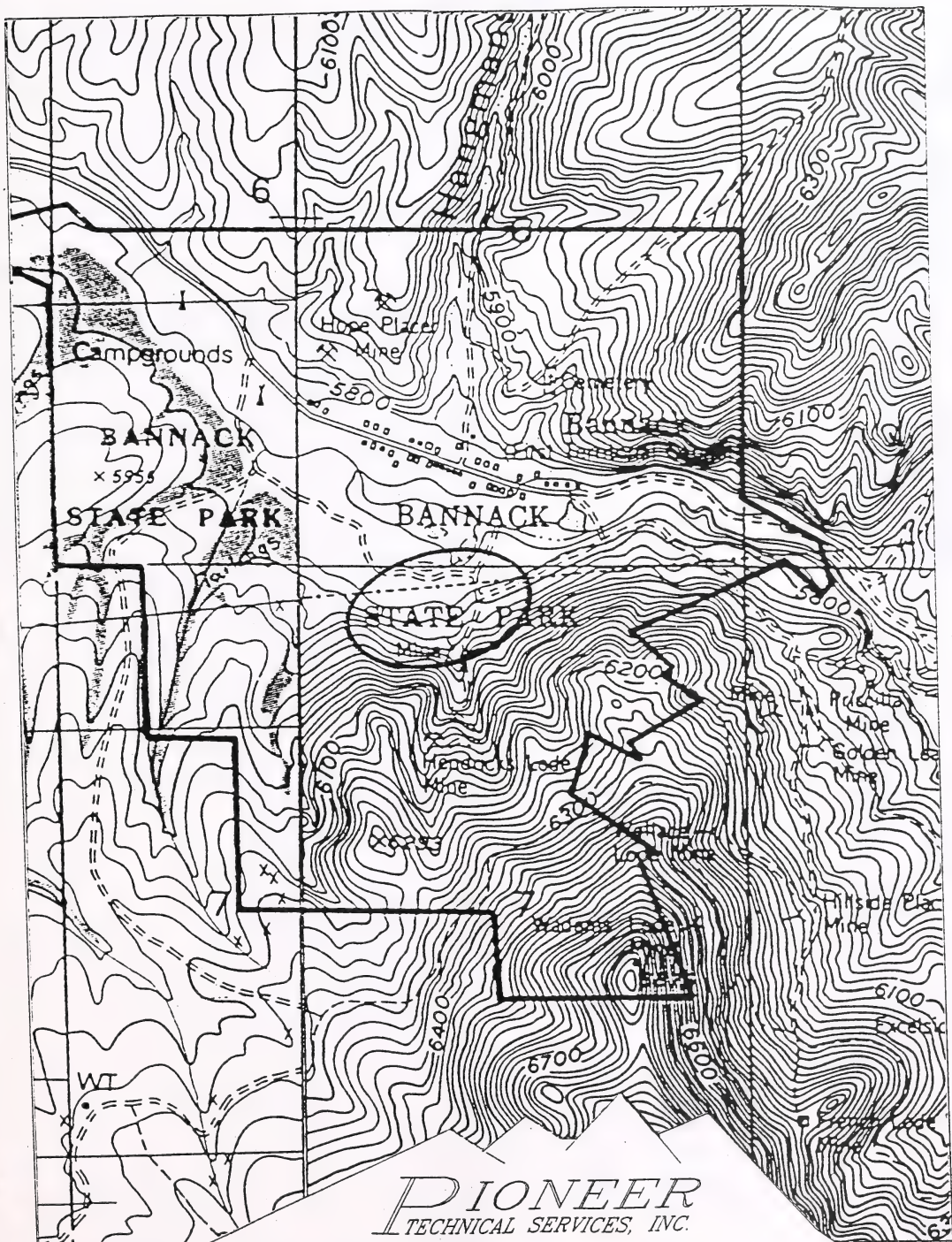
Mill Operation? Yes X, No     . If yes answer the next three questions:

Period(s) of Operation: 1919 to 1921 and 1933 to 1941

Origin of Ore Milled - Custom Mill      Dedicated Mill X; Number and names of mines that supplied mill feed: Hendricks Mine (more tailings are present than the recorded production from this mine; some custom milling may have occurred.)

Process? Hg-amalgam, CN<sup>-</sup> leach (vat, heap), floatation, smelting?  
Hg amalgamation, CN vat leach





*PIONEER*  
TECHNICAL SERVICES, INC.

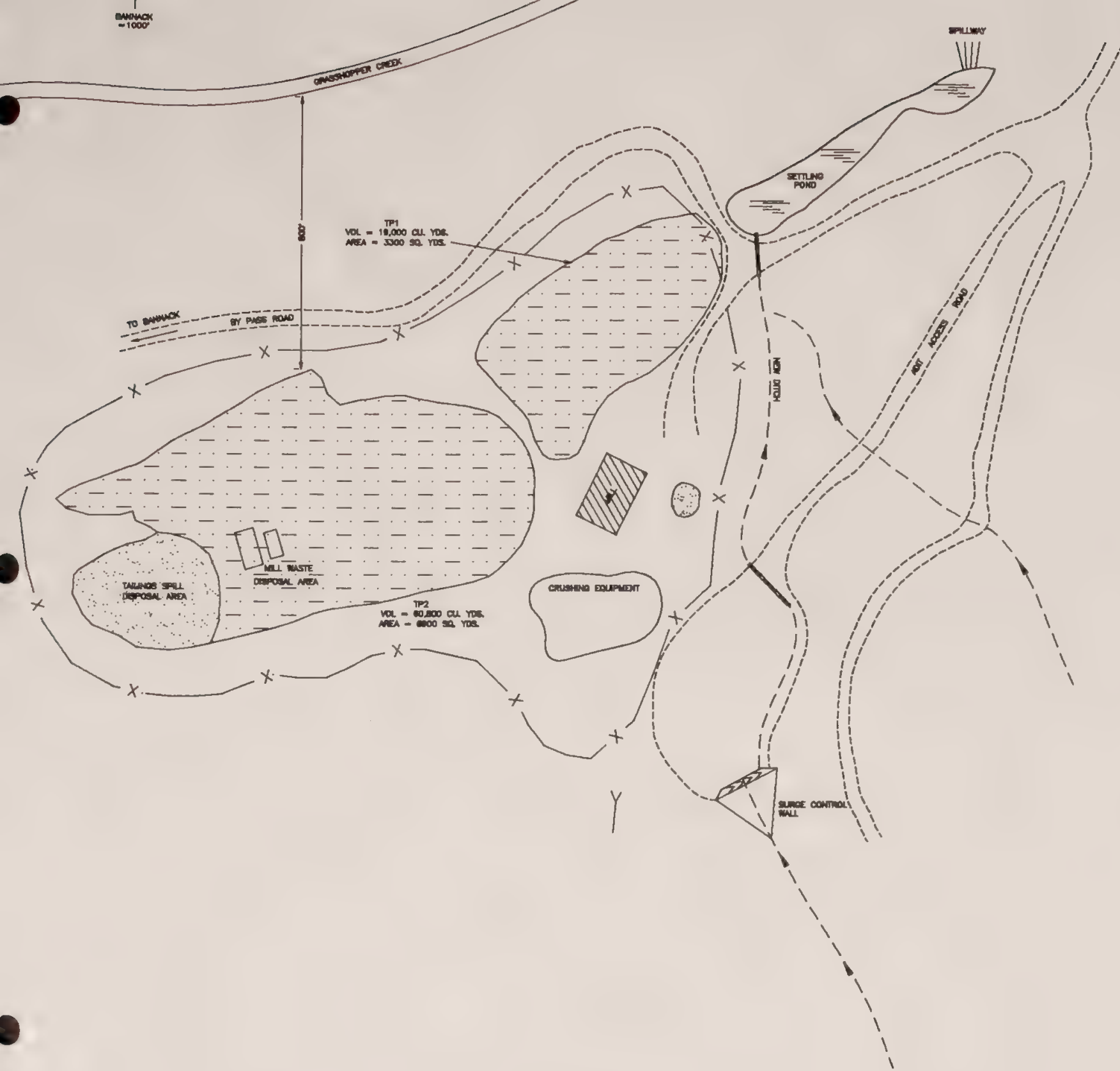
APEX MILLSITE, P.A. NO. 01-006

T08S, R11W, SECTION 07

SCALE: 1" = 1000'







SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CULVERT		OPEN ADIT
	LIGHT (LIGHT POLE)		COLLAPSED ADIT
	UTILITY POLE		OPEN SHAFT
	DECIDUOUS TREE		COLLAPSED SHAFT
	CONIFEROUS TREE		EXCAVATION
	WOOD FENCE		WHITE ROCK DUMP
	WIRE FENCE		COLLAPSED TIMBERS
	BUILDING		RAILS
	BANNER POST		SOIL SAMPLE
	GATE		XRF SAMPLE
	EDGE OF ASPHALT		WATER SAMPLE
	EDGE OF GRAVEL		GROUND AND SURFACE DRAINAGE
	SLOPE DIRECTION		WATER WELL
	TAILINGS POND		PONDED WATER
			VEGETATED WET LANDS

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

APEX MILL SITE PA# 01-006  
BANNICK DISTRICT BEAVERHEAD COUNTY

DATE 12/1/93  
JOB NO. 93-17  
DRAWN TPR  
DESIGNED INB  
APPROVED F.B. NO.  
THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON



SHEET NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
Tailings are primarily a fine sand to a sandy silt.

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Stratification occurs typically 4 to 6 feet below the surface.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Tailings are mostly dry, but moist near the bottom.

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Tailings impoundments are constructed from tailings and are currently in fair condition.

Comments on potential for mitigation: Grade, amend, and revegetate or cap and revegetate.



## SAMPLERS:

[illegible]

\*D-Direct reading(Kelway Meter); S-Saturated Paste(Orion Meter)

Comments or deviations from SOPs:



## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map.

Flowing adits: Yes ☐, No ☒, Number:  Identification:

Filled shafts: Yes ☐, No ☒, Number:  Identification:

Seeps/Springs: Yes ☐, No ☒, Number:  Identification:

Groundwater wells within 4 miles?: Yes ☒, No ☐;  
Number of well logs:  24

Distance to nearest well used for drinking? Approx. 1,000 feet to a  
campground well (slightly upgradient)

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?  
Definite ☐, Probable ☐, Possible ☐, Unlikely ☒.  
Based on existing monitoring data

Other observations/notes: The MBMG installed two monitoring wells for  
MDHES CECRA Program. Monitoring data did not document any exceedances  
of drinking water MCL's. Using the campground well as an upgradient  
sample, there were no observed releases to groundwater although arsenic  
was slightly elevated.



### SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Dry streambeds: Yes X, No   , Name(s): Small intermittent drainage from the Hendricks Lode down to the mill; a diversion has been constructed to route runoff around the site.

Waste materials within any floodplain: Yes X, No      Source ID(s): TP-1 and TP-2 are considered to be on the edge of the 100 year floodplain.

Estimated seasonal flow of stream(s) (cfs)?

Distance between waste source(s) and nearest surface water body (ft)?  
Approx. 800 feet

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Fishery, stock watering, irrigation

Observed erosional/sedimentation/stream turbidity problems? Yes \_\_\_\_\_,  
No X , Distance downstream (ft)? \_\_\_\_\_ Describe/explain (Note streambank  
stability and condition of streambank vegetation and any manmade structures or channel changes present):

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? Approx. 10 acres adjacent to the site

Wetlands present: Yes X, No     , Describe: Wetlands associated with Grasshopper Creek

Carbonate rocks/soils: Yes X, No     , Describe: Limestone is abundant in the area.

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 X; 10-30     ; 30-100     ; 100-300     ; 300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ; Comments     

Nearest residence(ft or miles)? Approx 1,500 feet

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



SAMPLERS: Bullock, Pierson

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe: Although tours are given in the mill

Population within 1 mile: 1-10 X; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments\_\_\_\_\_

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe:\_\_\_\_\_  
Bannack State Park has mill/adit tours.

Accessibility - Fences, warning signs, closed roads? Fence and warning signs are present around the site.

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes <u>X</u> , No____, Comment <u>Bannack State Park</u>
Wilderness Area -	Yes____, No <u>X</u> , Comment_____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment_____
Bat Habitat -	Yes____, No <u>X</u> , Comment_____

Primary Drainage\_\_\_\_; Secondary Drainage X; No Information\_\_\_\_:

Riparian Habitat Quality -	High____, Medium <u>X</u> , Low____
Wetlands Frontage -	High____, Medium <u>X</u> , Low____
Fisheries Habitat and Species Classification -	<u>4</u>
Sport Fishery Classification -	<u>4</u>

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No\_\_\_\_, Number 1, types and locations:\_\_\_\_  
There is one adit open at the site; it is gated and locked. Also, there are additional HMO's associated with the Hendricks Lode above the millsite.

Hazardous structures: Yes X, No\_\_\_\_, Number 1, types and locations:\_\_\_\_  
Mill building has been maintained and stabilized by MDFWP.

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain:\_\_\_\_\_



## **Bibliography**

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MDHES/SHWB, Bannack Apex Mill Sampling Plan and Analytical Results Report, 1987.

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MDHES/SHWB, Superfund Basics, Overview and Accomplishments of Superfund in Montana 1983-1993, November 1993.

USGS, Topographic Map, Bannack, Montana, 7 1/2 minute Quadrangle, 1962.



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

APEX MILLSITE  
PA NO. 01-006



# **AIMSS SCORESHEET**

SITE NAME:

APEX MILLSITE

PA NUMBER:

01-006

LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	40.923
6		WELLS - 1 MI. x 2.5		27.5
7	GW - TARGETS	WELLS - 1 TO 4 MI		14
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	41.5
10		<b>GROUNDWATER SCORE</b>	LINES 4 x 5 x 9	339661
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		0
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		2
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	40
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	40
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	48.661
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18	SW - TARGETS	WETLANDS		10
19		FISHERY		1
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	18
24		<b>SURFACE WATER SCORE</b>	LINES 14 x 15 x 23	35036
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		15
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	75
27		LIKELIHOOD SCORE	LINES 25 + 26C	75
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.240
29		POPULATION - 4 MILES		1
30	AIR - TARGETS	NEAREST RESIDENCE		0
31		WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	11
35		<b>AIR PATHWAY SCORE</b>	LINES 27 x 28 x 34	198
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.194
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		10
43		TARGETS SCORE	SUM LINES 40 - 42	11
44		<b>DIRECT CONTACT SCORE</b>	LINES 38 x 39 x 43	213
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			
	(LINES 10 + 24 + 35 + 44) / 100,000			3.75

SITE NAME:

APEX MILLSITE

PA NUMBER:

01-006

LINE  
NO.**SITE SAFETY**

1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	50
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	40
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	90
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		10
12		TARGETS SCORE	SUM LINES 9 - 11	11
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>9.90</b>



**SUMMARY OF HISTORICAL ANALYTICAL DATA  
FROM OTHER SOURCES**

Sample Number & Description										
Lab *	BA001 - composite outer mill soil surface	BA002A - composite surface away from vats	BA002B - composite surface away from vats	BA003 - composite surface away from vats	BA004 - composite surface near vats	BA005 - composite surface near vats	BA006 - 0"-6" grab soil location A	BA007 - 6"-12" grab soil location A	BA008 - 12"-18" grab soil location A	
p-H	8.01	8.03	7.96	7.96	7.79	7.58	---	---	---	---
T-Pb	862	1389	1421	800	230	257	290	64.8	159	
T-As	210	279	280	281	117	294	65.5	43.2	252	
T-Hg	5.4	2.8	2.6	1.6	4.8	1.3	20.6	3.5	2.8	
T-Cd	7.8	6.0	7.7	9.9	2.0	3.9	<1.0	<1.0	<1.0	
presumptive CN	negative	---	---	---	---	---	negative	negative	negative	
T-Cn	---	8.83	2.86	4.07	10.43	19.88	---	---	---	
T-Na	---	---	---	---	---	---	---	---	---	
T-Ca	---	---	---	---	---	---	---	---	---	
T-K	---	---	---	---	---	---	---	---	---	
* values in ppm, unless otherwise stated										
Lab	BA009 - field decon bank	BA010 - composite soil surface shed	BA012 - composite soil surface vat #9	BA014 - composite soil surface vat #2	BA015 - grab bottom of vat #2	BA016 - grab waste pile	BA017 - composite soil surface background	BA018 - grab soil surface near vat #9	BA019 - barrel waste	
p-H	---	8.16	8.22	8.12	---	12.22	8.10	9.66	11.36	
T-Pb	<.05 mg/l	2963	3513	138	202	---	<9.7	2135	---	
T-As	<.001 mg/l	140	126	52.5	388	---	6.6	161	---	
T-Hg	<.0004 mg/l	2.2	2.6	4.8	1.0	---	0.01	1.3	---	
T-Cd	<.005 mg/l	17.4	23.8	<1.0	<1.0	---	<1.0	13.8	---	
presumptive CN	negative	---	---	---	---	---	---	---	---	
T-Cn	---	1.12	0.31	11.3*	79.0	<.001	0.15	0.83	interferences	
T-Na	---	---	---	---	---	39.20%	---	---	31.60%	
T-Ca	---	---	---	---	---	637	---	---	77.7	
T-K	---	---	---	---	---	<19.3	---	---	311	
										* over holding time

			Sample Number & Description (Cont.)					
-----								
Lab *	BA020-	BA021-	BA022-	BA011-	BA024-	BA023-		
Analyses	0"-6" grab soil	6"-12" grab soil	12"-18" grab soil	grab-wood on inside of vat #9	grab wood on outside of vat #2	bur lap in vat #2		
	location B	location B	location B					
-----								
p-H	---	---	---	---	---	---		
T-Pb	96	75.3	319	819	85.6	146		
T-As	123	101	163	125	1070	794		
T-Hg	0.37	0.14	0.13	3.9	3.4	3.7		
T-Cd	<1.0	<1.0	<1.0	5.9	<1.0	<1.0		
presumptive CN	negative	negative	negative	---	---	positive		
T-Cu	---	---	---	---	---	---		
T-Na	---	---	---	---	---	---		
T-Ca	---	---	---	---	---	---		
T-K	---	---	---	---	---	---		

Table 2  
Laboratory QA/QC

Parameter	Lab Sample Number	Duplicates Concentration, ug/g		Relative Percent Differences of Duplicates		Spike % Recovery	NBS Reference	
							True Value	Observed Value
Cyanide	9824	.26	.36	32%		140%	EPA 586 .250	.279
	9829	.86	.80	7%			EPA 586 .250	.269
Ph	9816	7.96	7.96	0				
	9823	8.17	8.15	2%				
Pb	9820	64.8	63.7	.2%		97%	NBS 1645 714 ± 28	683
	9829	2135	2102					
Cd	9820	<1.0	<1.0	1%			NBS 1645 10.2 ± 1.5	9.9
	9829	13.8	12.0	8%				
Hg	9823	2.2	2.6	17%			NBS 1645 1.1 ± .5	N.D.
	9829	1.3	1.4	7%				
As	9820	43.2	48.3	11%			NBS 1645 (66)*	53.4
	9829	161	179	10%				
Ca							Ref.18-1 84.3	87.0
K							Ref.18-1 1.6	1.6
Na							Ref.18-1 57.6	57.1

\* non-certified value

Site	(1) Simple Cyanide ppm/soil	(1) Total Arsenic ppm/soil	EP Toxicity-ppm(2)							Presump- tive Cyanide	
			Silver	Arsenic	Barium	Cadmium	Chromium	Mercury	Lead		Selenium
Vat #1	0.20	800	.01	.076	1.25	<.005	<.02	<.10	.05	<.10	(+)
Vat #2	7.20	.691	.01	.087	1.68	<.005	<.02	<.10	.06	<.10	(-)
Vat #3	-0.1	800	.06	.078	1.36	.008	<.02	<.10	.14	<.10	(+)
Vat #4	-0.1	84	.06	<.05	1.36	<.005	<.02	<.10	.08	<.10	(+)
Vat #5	-0.1	135	.03	<.05	1.26	.01	<.02	<.10	.14	<.10	(-)
Vat #6	0.15	773	.03	.070	1.44	.02	<.02	<.10	.12	.11	(-)
Vat #7	-0.1	105	.04	.115	1.01	.01	<.02	<.10	.43	<.10	(-)
Floor #8	-0.1	177	.02	.10	1.51	.17	<.02	<.10	8.91	<.10	(-)
East Floor #9	-0.1	447	--	--	--	--	--	--	--	--	
Vat #9	--	--	.03	.05	.85	.21	<.02	<.10	8.84	<.10	(-)
Drums/Crusher	--	--	.07	.10	.09	<.005	<.02	<.10	.13	.12	(-)
Tailings Pond	--	--	.03	.09	.90	.17	<.02	<.10	7.38	<.10	(-)
EP Toxicity Limit (ppm)			5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0	

(1) Samples collected by FWSP and delivered to Northern Testing Lab, Billings, July 8, 1983.

(2) Samples collected by SNNB and delivered to DHES Lab August 31, 1983.



MINE WASTE STUDY  
ASSAY TEST RESULTS  
TABLE I

Sheet 2 of 2  
Job No. 82-543

Sample No.	Troy Ounces Per Ton of 2000 Pounds		Site	Boring, Test Pit or Hand Sample No.	Depth, feet
	Gold	Silver			
119347	Trace	0.4	Forest Rose Mine Dump	42	0 - 42
119348	0.01	0.4	Forest Rose Mine Dump	43	0 - 70
119349	0.01	0.1	Forest Rose Mill Dump	44	0 - 5
119350	0.01	1.0	Forest Rose Mill Dump	45	0 - 25
119351	0.03	0.8	Forest Rose Mill Dump	46	0 - 25
119352	Trace	0.2	Elk Horn Mine Dump	47	0 - 27
119353	Trace	Trace	Elk Horn Mine Dump	48	0 - 26
119355	Trace	0.2	Elk Horn Mine Dump	50	0 - 38.5
119356	Trace	0.8	Elk Horn Mill Dump	51	0 - 11.5
119357	Trace	0.6	Elk Horn Mill Dump	52	0 - 9
119359	Trace	0.8	Elk Horn Mill Dump	54	0 - 9
119360	0.01	0.6	Elk Horn Mill Dump	55	0 - 25
119361	Trace	2.2	Bannack Mill Dump (Upper)	56	0 - 25
119362	Trace	1.8	Bannack Mill Dump (Upper)	58	0 - 4
119364	Trace	0.8	Bannack Mill Dump (Upper)	59	0 - 11
119365	Trace	1.4	Bannack Mill Dump (Upper)	60	0 - 15
119366	Trace	0.4	Bannack Mill Dump (Upper)	61	0 - 14
119367	0.01	0.6	Bannack Mill Dump (Lower)	62	0 - 15
119369	Trace	0.6	Bannack Mill Dump (Lower)	64	0 - 3
119371	0.02	0.4	Bannack Mill Dump (Lower)	66	0 - 6



## NORTHERN TESTING LABORATORIES, INC.

MINE WASTE STUDY  
TRACE ELEMENT ANALYSIS  
TEST RESULTSJob No. 82-543  
Sheet 6 of 6

ppm in solid sample, unless noted

TABLE II

Lab Number	Sample Identification	Mercury	Selenium	Lead	Copper	Zinc	Antimony	Arsenic	Bismuth	Iron	Manganese	Molybdenum
119363	Bannack Upper Mill Dump Test Pit 58	0.12	1.03	864	112	1320	48	124	15	4650	3490	-20
119364	Bannack Upper Mill Dump Test Pit 59	0.52	0.99	702	147	903	-10	230	31	4.82*	2830	-20
119365	Bannack Upper Mill Dump Test Pit 60	0.17	1.29	1220	272	1330	-10	515	57	4.50*	5010	-20
119366	Bannack Upper Mill Dump Test Pit 61	0.59	1.27	396	729	448	-10	492	115	24.3*	1240	-20
119367	Bannack Lower Mill Dump Test Pit 62	0.62	0.90	432	1100	669	-10	460	54	28.5*	526	-20
119369	Bannack Lower Mill Dump Test Pit 64	0.20	1.11	532	1170	814	-10	391	32	23.2*	813	-20
119371	Bannack Lower Mill Dump Test Pit 66	0.20	1.02	668	1130	1010	-10	408	52	23.0*	779	-20

\*Reported in percent.  
A minus sign indicates less than the value reported was present in the sample.

CHEMISTRY LABORATORY BUREAU  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

REPORT TO: Solid and Hazardous Waste Bureau

ATTENTION: Carol Fox

SUBJECT: Analytical results for Bannack GW monitoring

Laboratory #:	Sample # or ID:	Sample Description:
SW 4063	BN-CC-01	dissolved only
SW 4064	BN-BL-01	total only
SW 4065	BN-GW-02	well #3 n. of road, diss. and total
SW 4066	BN-GW-01	upper cmpgrnd well, diss. and total
SW 4067	BN-GW-03	well #2, diss. and total (between road & tailing)
SW 4068	BN-GW-04	duplicate, diss. and total

SAMPLE HANDLING INFORMATION:

SAMPLES SUBMITTED BY:	Carol Fox
DATE SAMPLES COLLECTED:	09/14/89
DATE RECEIVED IN LABORATORY:	
DATE REPORTED BY LABORATORY:	11/13/89
RESPONSIBILITY CODE:	# 2231

LABORATORY #: all results in micrograms per gram

	As	Cd	Fe	Pb	Cu	Zn
<i>ss contamination</i> 4063 diss	<.001	<.001	<.01	<.001	<.001	.10
<i>blank</i> 4064 total	<.001	<.001	.01	<.001	<.001	<.00
<i>near gradient</i> 4065 diss	.024	<.001	1.56	<.001	<.001	<.00
4065 total	.078	.005	77.1	.084	.28	.31
<i>gradient</i> 4066 diss	.009	<.001	.11	<.001	<.001	.03
4066 total	.007	<.001	1.54	.002	.07	.13
<i>far gradient</i> 4067 diss	.019	<.001	1.12	<.001	<.001	<.00
4067 total	.023	.006	2.18	.050	.07	.04
4068 diss	.019	<.001	1.08	<.001	<.001	<.00
<i>dup.</i> 4068 total	.023	.010	1.72	.050	.06	.04

METHOD:

EPA 200.7 INDUCTIVELY COUPLED PLASMA Fe, Cd, Cu, Zn, Pb  
EPA 206.2 As (GRAPHITE FURNACE)  
EPA 213.2 Cd "  
EPA 239.2 Pb "  
EPA 220.2 Cu "

QUALITY ASSURANCE: results in micrograms per gram

	<u>As</u>	<u>Cd</u>	<u>Fe</u>	<u>Pb</u>	<u>Cu</u>	<u>Zn</u>
4063 diss dup			<.01		.002	<.00
4063 diss spike			100%		88%	101
4065 diss dup		<.001				
4065 diss spike		96%				
4068 diss dup	.019					
4068 diss spike	104%					
2693				1.5		
2693 dup				1.8		
2693 spike				91%		
4067 total	<u>As</u>	<u>Cd</u>	<u>Fe</u>	<u>Pb</u>	<u>Cu</u>	<u>Zn</u>
dup	.023	.005	2.24	.040	.06	.06
4067 total						
spike	--	90%	102%	94%	90%	86

REPORT SUBMITTED BY

*Judy Halm*

Judy Halm  
Chemist  
Chemistry Laboratory Bureau

DITES Sep 1 '88  
Sampling

CHEMISTRY LABORATORY BUREAU  
Management Services Division  
Montana Department of Health and Environmental Sciences

ANALYSIS REPORT

OWNER: Bannack

ADDRESS: \_\_\_\_\_

SOURCE INFORMATION: \_\_\_\_\_

DATE COLLECTED: \_\_\_\_\_ DATE RECEIVED: \_\_\_\_\_ SAMPLER: \_\_\_\_\_

LABORATORY SAMPLE NUMBER	<u>well between tailings &amp; road.</u> <u>BN-6W-02</u> SW9922 TOT	<u>well between tailings &amp; road</u> <u>BN-6W-03</u> SW9922 DISS	<u>dup # BN-6W</u> <u>BN-6W-03</u> SW9923 TOT
-----------------------------	--	--	--

ANALYSIS	RESULT				UNITS
As	.065	.016	.043	.014	mg/L
Cd	<.005	<.005	<.005	<.005	mg/L
Pb	<.05	<.05	<.05	<.05	mg/L
Zn	.516	.011	.271	.014	mg/L

REMARKS:

Date Analyzed: 9/12/88  
Analyst: DB

SW9922 TOT  
SW9922 DISS  
SW9923 TOT  
SW9923 DISS

CHEMISTRY LABORATORY BUREAU  
Management Services Division  
Montana Department of Health and Environmental Sciences

ANALYSIS REPORT

OWNER: Bannack

ADDRESS: \_\_\_\_\_

SOURCE INFORMATION: \_\_\_\_\_

DATE COLLECTED: \_\_\_\_\_ DATE RECEIVED: \_\_\_\_\_ SAMPLER: \_\_\_\_\_

LABORATORY  
SAMPLE NUMBER BN-6W-04 cont well N of Bannack RD.

SW 9924

DISS

ANALYSIS	RESULT	UNITS
<u>As</u>	<u>.027</u>	<u>mg/L</u>
<u>Cd</u>	<u>&lt;.005</u>	<u>mg/L</u>
<u>Pb</u>	<u>&lt;.05</u>	<u>mg/L</u>
<u>Zn</u>	<u>.015</u>	<u>mg/L</u>

REMARKS:

Date Analyzed: 9/12/88  
Analyst: DB

SW 9924 DISS

CHEMISTRY LABORATORY BUREAU  
Management Services Division  
Montana Department of Health and Environmental Sciences

ANALYSIS REPORT

OWNER: Bannack

ADDRESS: \_\_\_\_\_

SOURCE INFORMATION: \_\_\_\_\_

DATE COLLECTED: \_\_\_\_\_ DATE RECEIVED: \_\_\_\_\_ SAMPLER: \_\_\_\_\_

LABORATORY  
SAMPLE NUMBER UPPER Campground well  
BN-6W-01 BN-6W-01  
SW9921 SW9921  
TOT DISS

ANALYSIS	RESULT		UNITS
As	.012	.011	mg/L
Cd	.006	<.005	g
Pb	<.05	<.05	g
Zn	.046	.038	mg/L

REMARKS:

Date Analyzed: 9/12/88  
Analyst: DB

SW9921 TOT  
SW9921 DISS



CHEMISTRY LABORATORY BUREAU  
Management Services Division  
Montana Department of Health and Environmental Sciences

ANALYSIS REPORT

OWNER: Bannock

ADDRESS: \_\_\_\_\_

SOURCE INFORMATION: \_\_\_\_\_

DATE COLLECTED: \_\_\_\_\_ DATE RECEIVED: \_\_\_\_\_ SAMPLER: \_\_\_\_\_

LABORATORY	Blank	Cross Contamination	GC upstream	GC <del>downstream</del> upstream
SAMPLE NUMBER	BN-BL-01	BN-CC-01	BN-SW-01	BN-SW-01

	SW9916	SW9917	SW9918	SW9918
	TOT	DISS	TOT	DISS
ANALYSIS		RESULT		UNITS

As	<.001	<.001	.003	.002	mg/L
cd	<.005	<.005	<.005	<.005	}
PB	<.05	<.05	<.05	<.05	
ZN	<.005	<.005	<.005	<.005	mg/L

REMARKS:

Date Analyzed: 9/12/88  
Analyst: DB

SW9916 TOT  
SW9917 DISS  
SW9918 TOT  
SW9918 DISS

CHEMISTRY LABORATORY BUREAU  
Management Services Division  
Montana Department of Health and Environmental Sciences

ANALYSIS REPORT

OWNER: Bannack

ADDRESS: \_\_\_\_\_

SOURCE INFORMATION: \_\_\_\_\_

DATE COLLECTED: \_\_\_\_\_ DATE RECEIVED: \_\_\_\_\_ SAMPLER: \_\_\_\_\_

LABORATORY GC downstream GC downstream  
SAMPLE NUMBER BN-SW-02 BN-SW-03 BN-SW-03 (dupl.)

SW9919  
TOT

SW9919  
DISS

SW9920  
TOT

SW9920  
DISS

ANALYSIS \_\_\_\_\_ RESULT \_\_\_\_\_ UNITS \_\_\_\_\_

<u>As</u>	<u>.004</u>	<u>.002</u>	<u>.004</u>	<u>.003</u>	<u>mg/L</u>
<u>Cd</u>	<u>.007</u>	<u>&lt;.005</u>	<u>.006</u>	<u>&lt;.005</u>	<u>1</u>
<u>Pb</u>	<u>&lt;.05</u>	<u>&lt;.05</u>	<u>&lt;.05</u>	<u>&lt;.05</u>	<u>1</u>
<u>Zn</u>	<u>.011</u>	<u>&lt;.005</u>	<u>&lt;.005</u>	<u>&lt;.005</u>	<u>mg/L</u>
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

REMARKS:

Date Analyzed: 9/12/88  
Analyst: DB

SW9919 TOT  
SW9919 DISS  
SW9920 TOT  
SW9920 DISS

DILES March 1989  
Sd Sample

CHEMISTRY LABORATORY BUREAU  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

REPORT TO: Solid and Hazardous Waste Bureau

ATTENTION: Carol Fox

SUBJECT: Analytical results for Upper Campground well, Bannack

Laboratory #:      Sample # or ID:      Sample Description:

89W 0417      BN-GW-01      upper campground well

SAMPLE HANDLING INFORMATION:

SAMPLES SUBMITTED BY: Carol Fox  
DATE SAMPLES COLLECTED: 03/20/89  
DATE RECEIVED IN LABORATORY: 03/21/89  
DATE REPORTED BY LABORATORY: 03/30/89  
RESPONSIBILITY CODE: # 2221

LABORATORY #:      89 W 0417

	<u>TOTAL</u>	<u>DISSOLVED</u>
Pb	.009 mg/L	.002 mg/L
Cd	<.005 "	<.005 "
As	.031 "	.006 "
Zn	.343 "	.177 "
Cu	<.01 "	<.01 "
Fe	11.4 "	.08 "

METHOD:

Total metals digestion using concentrated Nitric acid. ICP and HGA instrumentation used for analyses.

QUALITY ASSURANCE:

Included as a separate report.

REPORT SUBMITTED BY:

Judy Hahn

CHEMIST  
CHEMISTRY LABORATORY BUREAU

RECEIVED

APR 08 1989

MONTANA DEPARTMENT OF HEALTH  
AND ENVIRONMENTAL SCIENCES  
SOLID & HAZARDOUS WASTE BUREAU

**CHEMISTRY LABORATORY BUREAU  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES**

REPORT TO: Solid and Hazardous Waste Bureau

ATTENTION: Carol Fox

SUBJECT: Analytical results for Well #3 north of Bannack Road

Laboratory #:      Sample # or ID:      Sample Description:

89 W 0418

BN-GW-02

Well #3 north of Bannack Rd.

SAMPLE HANDLING INFORMATION:

SAMPLES SUBMITTED BY:	Carol Fox
DATE SAMPLES COLLECTED:	03/20/89
DATE RECEIVED IN LABORATORY:	03/21/89
DATE REPORTED BY LABORATORY:	03/30/89
RESPONSIBILITY CODE:	# 2221

LABORATORY #:      89 W.0418

	<u>TOTAL</u>	<u>DISSOLVED</u>
Pb	.033 mg/L	<.001 mg/L
Cd	<.005 "	<.005 "
As	.068 "	.027 "
Zn	.158 "	.012 "
Cu	.04 "	<.01 "
Fe	31.8 "	2.24 "

METHOD:

Total metal digestion using concentrated Nitric acid. ICP and HGA instrumentation used for analyses.

QUALITY ASSURANCE:

Included as a separate report.

REPORT SUBMITTED BY:

*Judy Halm*

CHEMIST  
CHEMISTRY LABORATORY BUREAU

CHEMISTRY LABORATORY BUREAU  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

REPORT TO: Solid and Hazardous Waste Bureau

ATTENTION: Carol Fox

SUBJECT: Analytical results for Well #2 - west well

<u>Laboratory #:</u>	<u>Sample # or ID:</u>	<u>Sample Description:</u>
89 W 0419	BN-GW-03	Well #3 between road and tailings - west well

SAMPLE HANDLING INFORMATION:

SAMPLES SUBMITTED BY:	Carol Fox
DATE SAMPLES COLLECTED:	03/20/89
DATE RECEIVED IN LABORATORY:	03/21/89
DATE REPORTED BY LABORATORY:	03/30/89
RESPONSIBILITY CODE:	# 2221

LABORATORY #: 89 W 0419

	<u>TOTAL</u>	<u>DISSOLVED</u>
Pb	.023 mg/L	<.001 mg/L
Cd	<.005 "	<.005 "
As	.034 "	.015 "
Zn	.195 "	.012 "
Cu	.03 "	<.01 "
Fe	6.29 "	.36 "

METHOD:

Total metal digestion with concentrated Nitric acid. ICP and HGA instrumentation used for analyses.

QUALITY ASSURANCE:

Included as separate report.

REPORT SUBMITTED BY:

*Judy Holm*

CHEMIST  
CHEMISTRY LABORATORY BUREAU

CHEMISTRY LABORATORY BUREAU  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

REPORT TO: Solid and Hazardous Waste Bureau

ATTENTION: Carol Fox

SUBJECT: Analytical results for Well #4 near campground

<u>Laboratory #:</u>	<u>Sample # or ID:</u>	<u>Sample Description:</u>
89 W 0420	BN-GW-04	Well #4 near campground

SAMPLE HANDLING INFORMATION:

SAMPLES SUBMITTED BY:	Carol Fox
DATE SAMPLES COLLECTED:	03/20/89
DATE RECEIVED IN LABORATORY:	03/21/89
DATE REPORTED BY LABORATORY:	03/30/89
RESPONSIBILITY CODE:	# 2221

LABORATORY #: 89 W 0420

	<u>TOTAL</u>	<u>DISSOLVED</u>
Pb	.023 mg/L	<.001 mg/L
Cd	.005 "	<.005 "
As	.036 "	.015 "
Zn	.187 "	.013 "
Cu	.04 "	<.01 "
Fe	6.12 "	.37 "

METHOD:

Total metal digestion using concentrated Nitric acid. ICP and HGA instrumentation used for analyses.

QUALITY ASSURANCE:

Included as a separate report.

REPORT SUBMITTED BY:

*Judy Hahn*

CHEMIST  
CHEMISTRY LABORATORY BUREAU



CHEMISTRY LABORATORY BUREAU  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

REPORT TO: Solid and Hazardous Waste Bureau

ATTENTION: Carol Fox

SUBJECT: Analytical results for DI blank

Laboratory #:      Sample # or ID:      Sample Description:

89 W 0421

BN-BL-01

DI blank

SAMPLE HANDLING INFORMATION:

SAMPLES SUBMITTED BY:	Carol Fox
DATE SAMPLES COLLECTED:	03/20/89
DATE RECEIVED IN LABORATORY:	03/21/89
DATE REPORTED BY LABORATORY:	03/30/89
RESPONSIBILITY CODE:	# 2221

LABORATORY #:      89 W 0421

	<u>TOTAL</u>
Pb	<.001 mg/L
Cd	<.005 "
As	<.001 "
Zn	<.005 "
Cu	<.01 "
Fe	.08 "

METHOD:

Total metal digestion with concentrated Nitric acid. ICP and HGA instrumentation used for analyses.

QUALITY ASSURANCE:

Included as a separate report.

REPORT SUBMITTED BY:

*Judy Halm*

CHEMIST  
CHEMISTRY LABORATORY BUREAU

CHEMISTRY LABORATORY BUREAU  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

REPORT TO: Solid and Hazardous Waste Bureau

ATTENTION: Carol Fox

SUBJECT: Analytical results for cross contamination blank

<u>Laboratory #:</u>	<u>Sample # or ID:</u>	<u>Sample Description:</u>
89 W 0422	BN-CC-01	cross contamination blank

SAMPLE HANDLING INFORMATION:

SAMPLES SUBMITTED BY:	Carol Fox
DATE SAMPLES COLLECTED:	03/20/89
DATE RECEIVED IN LABORATORY:	03/21/89
DATE REPORTED BY LABORATORY:	03/30/89
RESPONSIBILITY CODE:	# 2221

LABORATORY #: 89 W 0422

	<u>TOTAL</u>
Pb	.001 mg/L
Cd	<.005 "
As	<.001 "
Zn	.009 "
Cu	<.01 "
Fe	.06 "

METHOD:

Total metal digestion using concentrated Nitric acid. ICP and HGA instrumentation used for analyses.

QUALITY ASSURANCE:

Included as a separate report.

REPORT SUBMITTED BY:

*Judy Hahn*

CHEMIST  
CHEMISTRY LABORATORY BUREAU

**CHEMISTRY LABORATORY BUREAU  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES**

REPORT TO: Solid and Hazardous Waste Bureau

ATTENTION: Carol Fox

SUBJECT: Analytical results for total metal digestion quality assurance

SAMPLE HANDLING INFORMATION:

SAMPLES SUBMITTED BY: Carol Fox  
DATE SAMPLES COLLECTED: 03/20/89  
DATE RECEIVED IN LABORATORY: 03/21/89  
DATE REPORTED BY LABORATORY: 03/30/89  
RESPONSIBILITY CODE:

LABORATORY #: ALL RESULTS IN MG/L - INFORMATION FOR TOTAL DIGESTIONS ONLY

	<u>Pb</u>	<u>Cd</u>	<u>As</u>	<u>Zn</u>	<u>Cu</u>	<u>Fe</u>
Blank	<.001	<.005	<.001	<.005	<.01	<.01
417	.009	<.005	.031	.342	<.01	11.6
417 duplicate	.009	<.005	.031	.344	<.01	11.2
419 spike	----	99%	----	99%	97%	89%
476-II	----	.056	----	.487	.397	.779
reference						
476-II actual value	----	.056	----	.474	.370	.788

Pb and As were analyzed on the HGA; spikes and reference sample were at levels above HGA limits.

All reference values are within acceptable limits.

METHOD:

Total metal digestion using concentrated Nitric acid. ICP and HGA instrumentation used for analyses.

REPORT SUBMITTED BY

*Judy Halm*

CHEMIST  
CHEMISTRY LABORATORY BUREAU

DHES March 1987  
gw sampling

CHEMISTRY LABORATORY BUREAU  
Centralized Services Division  
Montana Department of Health and Environmental Sciences  
ANALYSIS REPORT

RECEIVED

APR 06 1989

MONTANA DEPARTMENT OF HEALTH  
AND ENVIRONMENTAL SCIENCES  
SOLID & HAZARDOUS WASTE BUREAU

OWNER: C. Foy  
ADDRESS: SHWB mt. 5287  
SOURCE INFORMATION: upper campground well at Barnack - background  
Sample # BN-6W-01  
DATE COLLECTED: 3-20-89 SAMPLED BY C. Foy & K. Kirkley

ANALYSIS	Total	RESULT	Dissolved	UNITS
Pb*	.009		.002	mg/L ↓
Cd	<.005		<.005	
As	.031		.006	
Zn	.343		.177	
Co	<.01		<.01	
Fe	11.4		.08	

Pb DW limit is .005 mg/L; HGA limit is .001 mg/L

89W 0417

\* Please do the drinking water low-detection limit.

RC #4420221

Analyst JH Date Rec'd 3/21/89 Date Reported 3/27/89

CHEMISTRY LABORATORY BUREAU  
Centralized Services Division  
Montana Department of Health and Environmental Sciences  
ANALYSIS REPORT

OWNER: C. Fry

ADDRESS: SHW Berl 5287

SOURCE INFORMATION: well #3 north of Bernack Road

BN-6W-02

DATE COLLECTED: 3-20-89 SAMPLED BY C. Fox & K. Kierley

ANALYSIS	Total	RESULT	Dissolved	UNITS
Pb*	.033		<.001	mg/L
Cd	<.005		<.005	
As	.068		.027	
Zn	.158		.012	
Cu	.04		<.01	
Pb	31.8		2.24	

Pb DW limit is .005; HGA limit is .001 mg/L

89W 0418

\* Please do the drinking water lower detection limit

RC ~~442~~ 2221

Analyst JH Date Rec'd 3/21/89 Date Reported 3/27/89

CHEMISTRY LABORATORY BUREAU  
Centralized Services Division  
Montana Department of Health and Environmental Sciences  
ANALYSIS REPORT

OWNER: C. Fox

ADDRESS: SHWB apt. 5287

SOURCE INFORMATION: BV-CW-03

well #2 between road and tailings - west well

DATE COLLECTED: 3-20-89 SAMPLED BY C. Fox & K. Kierley

ANALYSIS	Total	RESULT	Dissolved	UNITS
Pb *	.023		<.001	mg/L ↓
Cd	<.005		<.005	
As	.034		.015	
Zn	.195		.012	
Cu	.03		<.01	
Pb	6.29		.36	

Pb DW limit is .005 mg/L; HGA limit is .001 mg/L

89W 0419

\*Please do drinking water detection limit

RL #2221

Analyst JH Date Rec'd 3/21/89 Date Reported 3/21/89



**CHEMISTRY LABORATORY BUREAU**  
Centralized Services Division  
Montana Department of Health and Environmental Sciences  
**ANALYSIS REPORT**

OWNER: C. Fox  
ADDRESS: SHUB ent. 5287  
SOURCE INFORMATION: BW-6W-04  
well #4 near campground well  
DATE COLLECTED: 3-20-89 SAMPLED BY C. Fox & V. Kirby

	Total	Dissolved	UNITS
ANALYSIS	RESULT		
Pb*	.023	<.001	mg/L ↓
Cd	.005	<.005	
As	.036	.015	
Zn	.187	.013	
Cu	.04	<.01	
Fe	6.12	.37	

Pb DW limit is .005 mg/L; HSA limit is .001 mg/L

89W 0420

Please do drinking water detection limit

Analyst JH Date Rec'd 3/21/89 Date Reported 3/27/89

RC # ~~2009-21~~

**CHEMISTRY LABORATORY BUREAU**  
Centralized Services Division  
Montana Department of Health and Environmental Sciences  
**ANALYSIS REPORT**

OWNER: C. Fox

ADDRESS: SHW B Mt. 5287

SOURCE INFORMATION: BN-BL-01

DI blank

DATE COLLECTED: 3-20-89 SAMPLED BY C. Fox & K. Kirkley

Total

ANALYSIS	RESULT	UNITS
Pb*	<.001	DW limit is .005mg/L; HGA is .001mg/L
cd	<.005	mg/L
AS	<.001	
Zn	<.005	
CU	<.01	
Fe	.08	

89 W 0421

Please do drinking water detection limit

Analyst JH Date Rec'd 3/21/89 Date Reported 3/27/89

RC #2221

OWNER: C. FOX  
ADDRESS: SHWB exl. 5287  
SOURCE INFORMATION: Bu-ee-01  
cross contamination blank  
DATE COLLECTED: 3-20-89 SAMPLED BY: C. FOX & K. KIRLEY

Total (but this was filtered for decou test)

please do drinking water detection Unit

A. H. 2221

Analyst JH Date Rec'd 3/2/89 Date Reported 3/27/89



MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: GOLD LEAF/PRISCILLA PA#: 01-031

Date: September 16, 1993 Time: 0800-1900

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Pierson, TD&H

Visitors: None

Weather/Seasonality Observations: Sunny; warm; slight breeze;  
cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #8: WR-1 (bottom);  
#9: WR-1 (top); #10: Broken lock; #11: French Lode (reclaimed);  
#12: Site between French Lode and Priscilla, WR-2; #13: Excelsior  
Mine, WR-3; #14: Excelsior Mine, shaft and adit; #15: Excelsior  
tailings, TP-2; #16: SW-1 sample location downstream in Grasshopper  
Creek; #17: Priscilla Mine, WR-4; #18: Priscilla adit; #19: Gold  
Leaf workings; #20: Gold Leaf tailings, TP-1.  
Video Tape No. 6

General Comments/Observations (not covered specifically in attached Inventory Forms):   
Also investigated the Hillside Wallace, French Lode, and Excelsior  
as inventoried.

Other Hazardous Materials/Substances Present: Located in the  
equipment storage area north of TP-1: Two 55 gal. barrels of lube  
oil; one 55 gal. barrel of hydraulic oil; one 55 gal. barrel of  
waste oil; and, one 55 gal. sealed barrel of unknown content.

General Comments on Potential Remedial Alternatives: Isolate  
tailings from Grasshopper Creek. Grade, amend, and revegetate  
waste rock dumps. Study is necessary to determine whether  
Excelsior tailings are impacting groundwater.





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): GOLD LEAF/PRISCILLA PA#: 01-031

Legal Description: T 8S ;R 11W ;Sec. 8 , NW1/4 1/4 1/4

County: BEAVERHEAD Mining District: BANNACK

Latitude: N 45° 09' 19"      Longitude: W 112° 59' 05"

**Primary Drainage Basin and Code:** Grasshopper Creek/10020002

Secondary Drainage Basin: Grasshopper Creek

USGS Quadrangle map name(s): Bannack

Mine Type/Commodities: Hardrock/Gold, Silver, Lead, Zinc, Copper;  
Placer/Gold

Activity Status: Active ,Inactive/Exploration ,Abandoned X .

Ownership status: Known YX N ; private/public? Private

Owner, Agent, or Contact (Include address and phone when available): Rob Towner,  
Box 4900, Bannack Road, Dillon, MT 59725.

Relationship to other mines/sites in the area/district: The Gold Leaf/Priscilla also included the Wallace, Wadam, Hillside, French Lode, and Excelsior mines.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? Recent placering conducted by Rob  
Towner was mostly graded and revegetated. MDSL/AMRB has recently  
conducted HMO closures and minor reclamation. Grasshopper Creek  
was rippedraped by the SCS in the 1970's.

General site features: Elevation 5800'-6400', Slope 4°-30°,  
Aspect Northeast

Land use: Mining X, Recreational     , Residential     , Urban     ,  
Agricultural     , Other(Specify) Next to Bannack State Park

Area of disturbed/unvegetated lands? Approx. 10 acres.  
Dimensions:

Predominant vegetation types: Douglas fir, juniper, sage, bunch grass

Access: roads - good\_\_\_, poor X , 4wd\_\_\_, trail\_\_\_.  
Other logistical considerations (proximity to other sites). Locked  
cable gates east of Bannack

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are 8 well logs within a 1 mile radius.

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General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). The site is situated along the south side  
of Grasshopper Creek. The ore bodies consist of a series of  
interconnected and irregular replacement bodies localized in white  
to bluish-white marmorized limestone of the Madison Group. The  
limestone is in contact with granodiorite on the western margin and  
the ore generally occurs outside garnetized zones adjacent to the  
granodiorite.

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Mining/milling history, ore type/tenor, host rock, gangue: The  
Gold Leaf mines are in quartz deposits originally located between  
1864 and 1874. Underground workings are extensive totalling more  
than 18,000 feet of drifts, winzes, and raises. The mines changed  
ownership many times over the last 100 years and was last operated  
in the 1960's with recent exploration work conducted in the 1980's.  
Recorded production from 1902 to 1965 was 30,441 oz. Au, 96,043 oz.  
Ag, 11,372 lbs. Cu, 102,824 lbs. Pb, and 300 lbs. Zn from 96,485  
tons of ore. Replacement bodies contain gangue of quartz; some  
contain lead-silver ore; some contain silver, copper and gold ore;  
and, some are low-grade free gold. Gold occurs as free and in  
auriferous pyrite. Oxidized ore, red-brown earthy iron oxides  
containing gold, mostly in pyrite; also present are chalcopyrite,  
cerussite, anglesite, and galena. Some calcite observed in gangue  
along with garnet and epidote.

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Mine Operation?

Shafts - Yes X, No    , # 1, Comment Excelsior  
Adits - Yes X, No    , # 6, Comment Access controlled except  
Priscilla  
Pits - Yes X, No    , # 2, Comment Wallace/Wadam  
Placers - Yes X, No    , # 3, Comment Dredging and hydraulic  
Other - Yes    , No X, #    , Comment                   

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Mill Operation? Yes X, No    . If yes answer the next three  
questions:

Period(s) of Operation: 1885, original Gold Leaf mill; 1910, new  
250-ton mill; 1929, 100-ton cyanidation mill

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Origin of Ore Milled - Custom Mill     Dedicated Mill X; Number and  
names of mines that supplied mill feed:                                   

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Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
Floatation and cyanide

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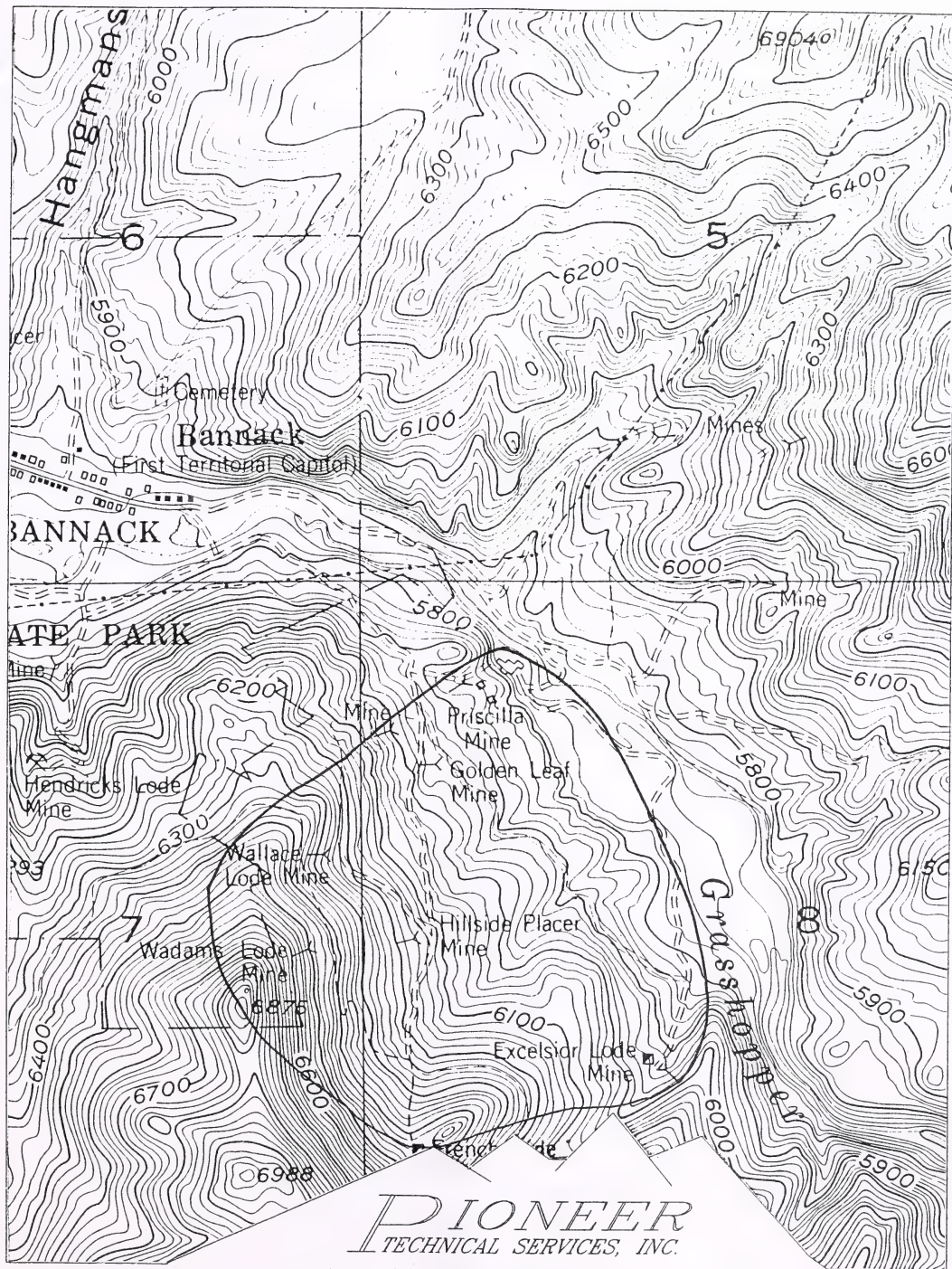
Montana Bureau of Mines and Geology  
Water Well Log Data

10/15/1993

Well No.	Location	Depth	Yield	Static Water Level
M:109968	08S 11W 06	38.0	10.0	0.00
M:109969	08S 11W 06 CC	30.0	20.0	10.00
M:109970	08S 11W 06 CD	75.0	20.0	20.00
M:109973	08S 11W 06 DC	41.0	20.0	23.00
M:109971	08S 11W 06 DC	20.0	20.0	10.00
M:109972	08S 11W 06 DC	17.0	20.0	10.00
M:109974	08S 11W 06 DC	48.0	20.0	23.00
M:109975	08S 11W 06 DD	56.0	20.0	27.00







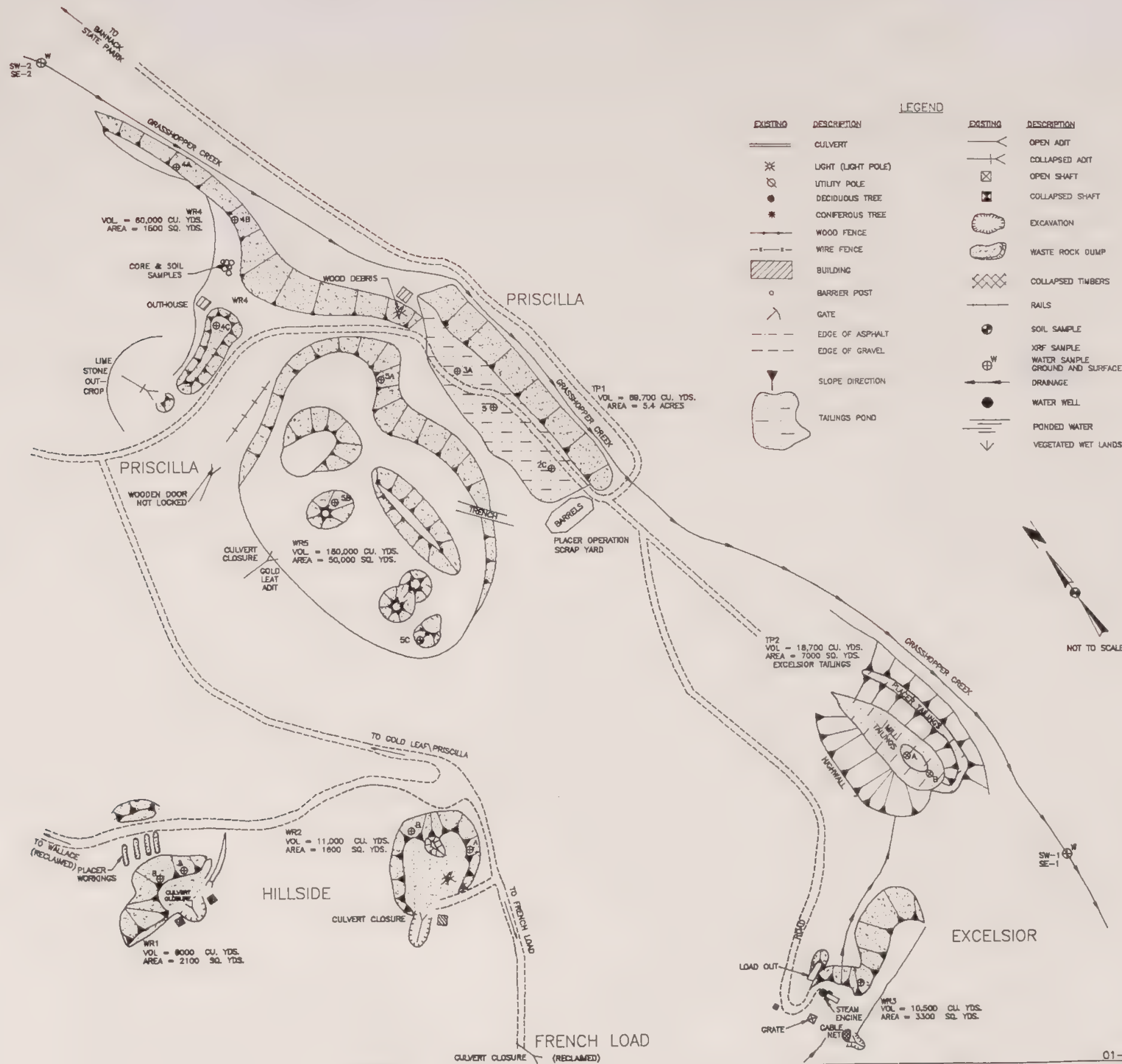
GOLD LEAF/PRISCILLA, P.A. NO. 01-031

T08S, R11W, SECTION 08

SCALE: 1" = 1000'







MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY  
GOLD LEAF PRISCILLA PA# 01-031  
BANNACK DISTRICT BEAVERHEAD COUNTY

DATE 12/10/93  
JOB NO. 93-17  
DRAWN CAJ  
DESIGNED TFR  
APPROVED WJB  
F.B. NO.  
PIONEER  
INCORPORATED SURVIVORS, INC., BUTTE, MT.  
THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA  
WASHINGTON



SHEET NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
Estimated 40% fine sand and 60% silt

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): No stratification observed at the Golden Leaf Tailings. Reduced zone at Excelsior Tailings was not measured for depth due to saturated condition.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Golden Leaf is mostly dry; Excelsior Tailings are saturated below 3 feet.

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Riprap in good condition along the Golden Leaf Tailings.

Comments on potential for mitigation: Isolate from creek and alluvial groundwater; need monitoring to determine impacts to groundwater from Excelsior Tailings.



## SOURCE INVENTORY FORM

SAMPLERS: Bullock, Pierson

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	DE SU (D/S) <sup>1</sup>	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
TP-1A	TAIL	69,700	Gold Leaf Tails., north end; 0-2.5' orange sand	Riprapped Berm	NM	NM	01-031-TP-1	09/16/93 1220	T-Metals, ABA, CN-
TP-1B-A	TAIL		Center of pond; 0-2', orange sand	Riprapped Berm	NM	NM			
TP-1B-B	TAIL		Center of pond; 2-4', orange sand	Riprapped Berm	NM	NM			
TP-1C-A	TAIL		South end; 0-2', orange sand	Riprapped Berm	NM	NM	01-031-TP-2	09/16/93 1230	T-Metals, ABA, CN-
TP-1C-B	TAIL		South end; 2-8', tan sand	Riprapped Berm	NM	NM			
TP-1C-C	TAIL		South end; 8-15', tan sand	Riprapped Berm	NM	NM			
TP-2A	TAIL	18,700	Excelsior Tails., south end; 0-10', wet silt	Placered Depression	NM	NM	01-031-TP-3	09/16/93 1240	T-Metals, ABA, CN-
TP-2B	TAIL		Center of pond; 0-4', wet silt	Placered Depression	NM	NM			
WR-1A	WR	6,000	Hillside Mine, south end	None	6.8 (D)	0.04	01-031-WR-1	09/16/93 1130	T-Metals, ABA
WR-1B	WR		Hillside Mine, north end	None	6.9 (D)	0.03			
WR-2A	WR	11,000	Lower Hillside, south end	None	< 3.5 (D)	0.04			
WR-2B	WR		Lower Hillside, north end	None	6.4 (D)	0.03			
WR-3	WR	10,500	Excelsior Mine	None	6.9 (D)	0.035	N/A	N/A	XRF Analysis
WR-4A	WR	60,000	Priscilla, north end; red sand	None	6.4 (D)	0.03	01-031-WR-2	09/16/93 1135	T-Metals, ABA
WR-4B	WR		Priscilla, central; red/gray sand	None	< 3.5 (D)	0.03			
WR-4C	WR		Priscilla, southern pile; green	None	4.4 (D)	0.04			
WR-5A	WR	180,000	Gold Leaf, north; red sand	None	< 3.5 (D)	0.04			
WR-5B	WR		Gold Leaf, central pile; tan sand	None	6.2 (D)	0.04			
WR-5C	WR		Gold Leaf, south	None	NM	NM			

<sup>1</sup> D-Retest reading (Recovery Meter); S-Retesting Rate (Cesium Meter)

Comments or deviations from SOPs: 01-031-TP-1 is composite of TP-1A and TP-1B-A and -1B-B. 01-031-TP-2 is composite of TP-1C-A through -1C-C. 01-031-TP-3 is composite of TP-2A and -2B. 01-031-WR-1 is composite of WR-1A and -1B, and WR-2A and -2B. 01-031-WR-2 is composite of WR-4A through -4C, and WR-5A through -5C. NM = Not Measured



## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Filled shafts: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Seeps/Springs: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Groundwater wells within 4 miles?: Yes X, No\_\_\_;  
Number of well logs: 25

Distance to nearest well used for drinking? 0.25 mile upgradient -  
Bannack

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite\_\_\_, Probable\_\_\_, Possible X, Unlikely\_\_\_.

Due to groundwater contact with tailings in the Grasshopper Creel floodplain; tailings contain elevated levels of metals.

Other observations/notes: N/A



### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): Grasshopper Creek

Dry streambeds: Yes X, No     , Name(s): Two unnamed intermittent drainages to Grasshopper Creek

Other surface water: Yes     , No X, Name(s)/Description:     

Waste materials within any floodplain: Yes X, No      Source ID(s): TP-1 and TP-2

Approximate Flood frequency?      1 yr, X 10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)? 10

High Flow: 100 cfs, Average Flow: 10 cfs

Distance between waste source(s) and nearest surface water body (ft)? 10 feet between Grasshopper Creek and TP-1

Surface water draining onto or through waste sources: Yes     , No X, Describe:     

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Agriculture, irrigation, fishery

Observed erosional/sedimentation/stream turbidity problems? Yes X, No     , Distance downstream (ft)? 100+ Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Visual increase in sediment bed load below disturbed area.

## SAMPLERS:

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

#### D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? 5 to 10 acres in the floodplain;  
little area downstream of mine is available due to canyon

Wetlands present: Yes , No X , Describe:

Carbonate rocks/soils: Yes X, No     , Describe: Madison Limestone is abundant.

### E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10\_\_\_; 10-30 X; 30-100\_\_\_;  
100-300\_\_\_; 300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or  
greater\_\_\_; Comments

Nearest residence(ft or miles)? 0.3 miles to Bannack State Park  
Caretaker residence

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:

observed	high	moderate	low	none
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**SAMPLERS:** Bullock

[illegible]

Comments or Deviations from the SOPs (Pioneer SAP, 1993):



## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe: \_\_\_\_\_

Population within 1 mile: 1-10 X; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments \_\_\_\_\_

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: Off-  
road vehicle tracks

Accessibility - Fences, warning signs, closed roads? Locked cable  
gates on roads

Sensitive environments on-site or adjacent to site:

State or National Parks - Yes X, No\_\_\_\_, Comment Near Bannack State  
Wilderness Area - Yes\_\_\_\_, No X, Comment \_\_\_\_\_  
T&E Species Habitat - Yes\_\_\_\_, No X, Comment \_\_\_\_\_  
Bat Habitat - Yes X, No\_\_\_\_, Comment Possible

Primary Drainage\_\_\_\_; Secondary Drainage X; No Information\_\_\_\_:

Riparian Habitat Quality - High\_\_\_\_, Medium X, Low\_\_\_\_  
Wetlands Frontage - High\_\_\_\_, Medium X, Low\_\_\_\_  
Fisheries Habitat and Species Classification - 4  
Sport Fishery Classification - 4

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No\_\_\_\_, Number 7, types and locations:\_\_\_\_  
Six adits, five of which are secured; one shaft with grate.

Hazardous structures: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes X, No\_\_\_\_, Number 1,  
types and locations: Dangerous highwall above the Excelsior Tailings.

Unstable waste piles, impoundments, undercut banks: Yes\_\_\_\_, No X,  
Number\_\_\_\_, types and locations:\_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain:\_\_\_\_\_

# ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Bullock, Pierson

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/NO DUST/LOW/NONE)
TP-1	Low pH	Dry	235,000	152,750	Yes	Moderate
TP-2	Low pH	Partial	63,000	63,000	Yes	Low
WR-1	SO3	Dry	18,900	18,000	Yes	Low
WR-2	SO3; low pH	Dry	14,400	13,680	Yes	Low
WR-3	None	Dry	29,700	26,730	Yes	Low
WR-4	Low pH; SO3	Dry	13,500	11,475	Yes	Low
WR-5	Low pH; SO3	Dry	450,000	427500	Yes	Low

Notes and Clarifications:



## Bibliography

- Engineering and Mining Journal, Volume 64, The Mineral Formation of the Golden Leaf Mines, Written by Robert W. Barrell, July 17, 1897.
- MBMG, Geology and Ore Deposits of Bannack and Argenta, Montana, Bulletin 6, Written by Philip J. Shenon, January 1931, pp. 41-42.
- MBMG, Mines and Mineral Deposits (Except Fuels), Beaverhead County, Montana, Bulletin 85, Author Unknown, April 1972, pp. 83-84.
- MBMG, Well Log Database, September 8, 1993.
- MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.
- MDSL/AMRB, Environmental Assessment Analytical Data for Gold Leaf/Priscilla, Prepared by MSE, Inc., November 7, 1990.
- MDSL/AMRB Files, Abandoned Mine Lands Portal Inventory for Gold Leaf and Priscilla Mines, Prepared by Daphne Digirindakis, October 27, 1993.
- MDSL/AMRB Files, Letter to Mr. J.C. Archibald Regarding Development Work at Bannack, Author Unknown, February 25, 1939.
- USGS, Topographic Map, Bannack, Montana, 7 1/2 minute Quadrangle, 1952.



LABORATORY ANALYTICAL DATA

GOLD LEAF/PRISCILLA  
PA NO. 01-031



Gold Leaf/ Priscilla PA# 01-031  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 09/16/93

SOLID MATRIX ANALYSES

Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
01-031-SE-1	9.41 J	178 J	1.4 U	5.99	5.81 J	19.9	8660 JX	0.16 J	723	12.2	12	9.47 UJ	56.4 J	NR
01-031-SE-2	18.3 J	108 J	0.9 U	3.89	1.64 J	3.13	5420 JX	0.032 U	400	5.46	6.39 UJ	6.17 UJ	28.5 J	NR
01-031-TP-1	593 J	198 J	4.4 J	22.7	12.7 J	789	94000 JX	4.09 J	937	17.5	589	36.9 J	629 J	2.51
01-031-TP-2	429 J	118 J	4.3 J	19.4	11.1 J	902	98100 JX	4.59 J	573	10.6	988	30 J	587 J	3.54
01-031-TP-3	198 J	217 J	2.6 J	42.5	8.03 J	925	34800 JX	11.4 J	1360	17.3	360	20.1 J	345 J	0.142 U
01-031-WR-1	72.8 J	60.4 J	1.3 J	16.1	4.52 J	392	49000 JX	0.547 J	454	10.6	12.1	4.86 UJ	91.1 J	NR
01-031-WR-2	116 J	55.8 J	1.1 J	12.3	7.97 J	483	49700 JX	0.788 J	536	18.6	38.7	9.41 J	93.8 J	NR
BACKGROUND	76	134	0.5 U	3	10	14.1	12100	0.024 J	482	10	23	7 J	59	NR

Acid/Base Accounting

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

FIELD ID	TOTAL SULFUR %	TOTAL ACID BASE t/1000	NEUTRAL POTENT. t/1000	SULFUR ACID BASE POTENT. t/1000	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE t/1000	SULFUR ACID BASE POTENT. t/1000
01-031-TP-1	0.25	7.81	73.8	66	0.22	<0.01	0.03	0	73.8
01-031-TP-2	0.34	10.6	74.3	63.7	0.26	0.02	0.06	0.62	73.7
01-031-TP-3	0.26	8.12	137	129	0.19	0.05	0.02	1.56	135
01-031-WR-1	3.53	110	176	66.1	<0.01	2.46	2.39	76.9	99.5
01-031-WR-2	1.48	46.2	115	68.4	0.67	0.36	0.45	11.2	103

WATER MATRIX ANALYSES

Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
01-031-SW-1	2.62	51	4.59 U	5 U	6.24 U	7.3	228	0.12 U	22.3	74.4	1.14	31.7 U	248	84
01-031-SW-2	1.73	50.5	4.59 U	5 U	6.24 U	2.33 U	215	0.12 U	15.6	10.9 U	1.3	31.7 U	8.71 U	82.9

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry

Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NOS/NO2-N	CYANIDE
01-031-SW-1	141	6	16	< 0.05	NR
01-031-SW-2	182	6	17	0.05	NR

LEGEND

SE1 - Downgradient of tailing pond 2 on Grasshopper Creek.  
SE2 - Upgradient of waste rock dump 4 on Grasshopper Creek.  
TP1 - Composite of subsamples TP1A, 1B-A, and 1B-B.  
TP2 - Composite of subsamples TP2A, 1C-A, and 1C-B.  
TP3 - Composite of subsamples TP2A and 2B.  
WR1 - Composite of subsamples WR1A, 1B, 2A, and 2B.  
WR2 - Composite of subsamples WR4A, 4B, 4C, 5A, 5B, and 5C.  
BACKGROUND - From the F. Mont Mill (01-006-SS-1).

SW1 - Same as sample SE1.  
SW2 - Same as sample SE2.





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

GOLD LEAF/PRISCILLA  
PA NO. 01-031



# **AIMSS SCORESHEET**

SITE NAME: GOLD LEAF/ PRISCILLA  
PA NUMBER: 01-031

LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	86,260
6		WELLS - 1 MI. x 2.5		20.0
7	GW - TARGETS	WELLS - 1 TO 4 MI		17
8		NEAREST WELL		5
9		TARGETS SCORE	LINES 6 + 7 + 8	42.0
10		<b>GROUNDWATER SCORE</b>	LINES 4 x 5 x 9	1449168
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		50
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	750
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	102,414
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		0
19	SW - TARGETS	FISHERY		1
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	8
24		<b>SURFACE WATER SCORE</b>	LINES 14 x 15 x 23	614484
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		15
26B		DISTANCE TO POPULATION		10
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	150
27		LIKELIHOOD SCORE	LINES 25 + 26C	150
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.458
29		POPULATION - 4 MILES		10
30		NEAREST RESIDENCE		5
31	AIR - TARGETS	WETLANDS		10
32		PARKS / WILDERNESS		10
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	35
35		<b>AIR PATHWAY SCORE</b>	LINES 27 x 28 x 34	2405
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		5
37B		DISTANCE TO POPULATION		10
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.366
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		1
41		NEAREST RESIDENCE		5
42		RECREATIONAL USE		2
43		TARGETS SCORE	SUM LINES 40 - 42	8
44		<b>DIRECT CONTACT SCORE</b>	LINES 38 x 39 x 43	293
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			
	(LINES 10 + 24 + 35 + 44) / 100,000			20.66

SITE NAME: GOLD LEAF/ PRISCILLA  
 PA NUMBER: 01-031

LINE NO.	<u>SITE SAFETY</u>			
1	THREAT	ACCESSIBILITY		5
2		OPEN SHAFTS	100 EA.	100
3		OPEN ADITS	50 EA.	300
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	75
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVES		0
7		HAZ. MATERIALS		100
8		HAZARDS SCORE	SUM LINES 2 - 7	575
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		5
11		RECREATIONAL USE		2
12		TARGETS SCORE	SUM LINES 9 - 11	8
13		SITE SAFETY SCORE	(LINES 1 x 8 x 12) / 1,000	23.00

**SUMMARY OF HISTORICAL ANALYTICAL DATA  
FROM OTHER SOURCES**





DATE: November 7, 1990

CLIENT: Abandoned Mines

FIELD ID: Tailings along Grasshopper Creek below Bannack

LAB NO: S2780

DATE RECEIVED: 10/18/90

pH (1:1 slurry) 7.70 SU

Total Metals

As 246 mg/Kg

Cd 1.95 mg/Kg

Cu 428 mg/Kg

Fe 67.200 mg/Kg

Pb 430 mg/Kg

Zn 369 mg/Kg





XRF ANALYSIS RESULTS

GOLD LEAF/PRISCILLA  
PA NO. 01-031











01-031, #8: WR-1 (bottom) location in Grasshopper Creek



01-031, #9: WR-1 (top) PISCATAWAY



01-031, #10: Lock for next section



01-031, #11: French Lode (reclaimed)





01-031, #12: Site between French Lode and Priscilla



01-031, #13: WR-3 at Excelsior Mine

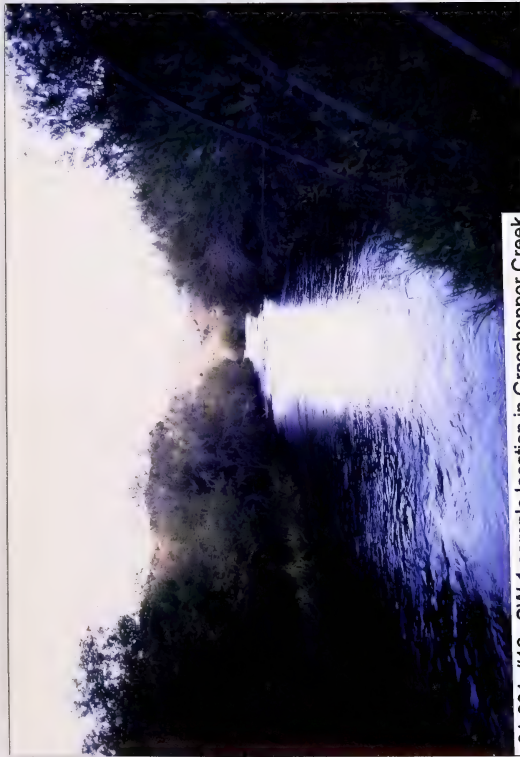


01-031, #14: Shaft and adit at Excelsior Mine

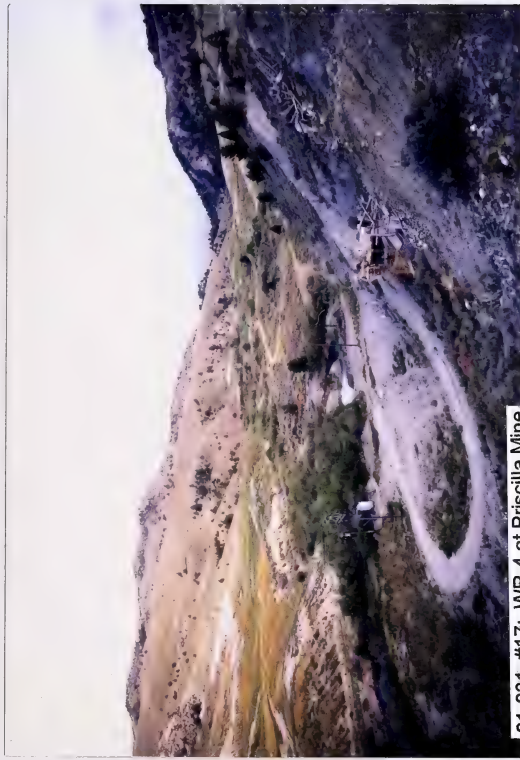


01-031, #15: TP-2 at Excelsior Tailings





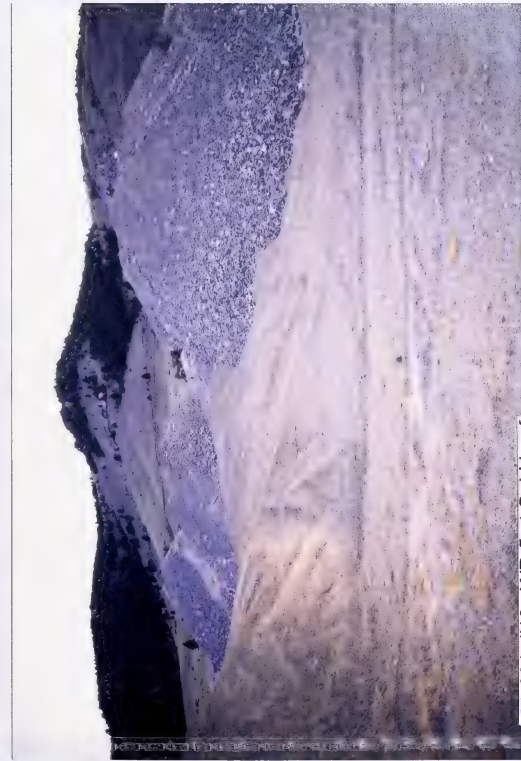
01-031, #16: SW-1 sample location in Grasshopper Creek



01-031, #17: WR-4 at Priscilla Mine



01-031, #18: Priscilla Adit at mine



01-031, #19: WR-5 at Gold Leaf



01-031, #20: TP-2 at Gold Leaf Tailings

BIRCH CREEK





MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: INDIAN QUEEN PA#: 01-034

Date: June 15, 1993 Time: 0830

Field Team Leader: Babits, Pioneer

Sampling Personnel: Belanger, Lasher, Clark;  
Pioneer  
Pierson; TD&H

Visitors: University of Montana Geology Field  
Camp

Weather/Seasonality Observations: Rainy morning; to partly  
cloudy; warm (55°F); slight breeze; cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #13: Adit R9-10;  
#14: Adit east of R9-10; #15: Adit downgradient of R9-10  
(barbwire); #16: WR-2; #17: Shaft #3; #18: WR-3; #19: Adit #4;  
#20: WR-3B; #21: Shaft #2; #22: Trench; #23: Adit; #24: WR-4 and  
-5; #25: Adit; #26: R9-10; #27: Smelting site. Video Tape No. 1.

General Comments/Observations (not covered specifically in attached Inventory Forms): Access to site by truck.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Waste rock  
could be reprocessed for copper; otherwise, recontour, coversoil,  
amend, and revegetate.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): INDIAN QUEEN PA#: 01-034

Legal Description: T 5S ; R 10W ; Sec. 15 , NE1/4 SE1/4 1/4

County: BEAVERHEAD Mining District: BIRCH CREEK

Latitude: N 45° 53' 55" Longitude: W 112° 49' 10"

Primary Drainage Basin and Code: Big Hole/10020004

Secondary Drainage Basin: Birch Creek

USGS Quadrangle map name(s): Twin Adams Mountain

Mine Type/Commodities: Hardrock/Copper

Activity Status: Active      , Inactive/Exploration      , Abandoned X .

Ownership status: Known YX N ; private/public? Private

Owner, Agent, or Contact (Include address and phone when available): Donald W. and Keith P. Johnson, First National Bank Building, Butte, MT 59701. (406) 723-5411; Susan Mertz, 182 W. Avenida Junipero, San Clemente, CA 92672.

Relationship to other mines/sites in the area/district: Smelter is downgradient on Birch Creek.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? Some closures have been performed.

General site features: Elevation 6400' , Slope 24° ,  
Aspect Southeast

Land use: Mining      , Recreational X , Residential      , Urban      ,  
Agricultural      , Other (Specify)     

Area of disturbed/unvegetated lands? 1.25 acres.  
Dimensions:     

Predominant vegetation types: Sagebrush, cedar trees

Access: roads - good      , poor      , 4wd X , trail X .  
Other logistical considerations (proximity to other sites). 4x4 up road, then 200' walk down; walk up from road above Indian Queen.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are 2 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Birch Creek flows northwest to southeast  
south of the site. Granite with copper and pyrite, manganese and  
iron staining.

Mining/milling history, ore type/tenor, host rock, gangue: No  
information available.

Mine Operation?

Shafts - Yes X, No     , # 1, Comment Closed  
Adits - Yes X, No     , # 7, Comment 1 fenced; 3 collapsed  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

Mill Operation? Yes     , No X. If yes answer the next three  
questions:

Period(s) of Operation: N/A

Origin of Ore Milled - Custom Mill      Dedicated Mill     ; Number and  
names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
N/A

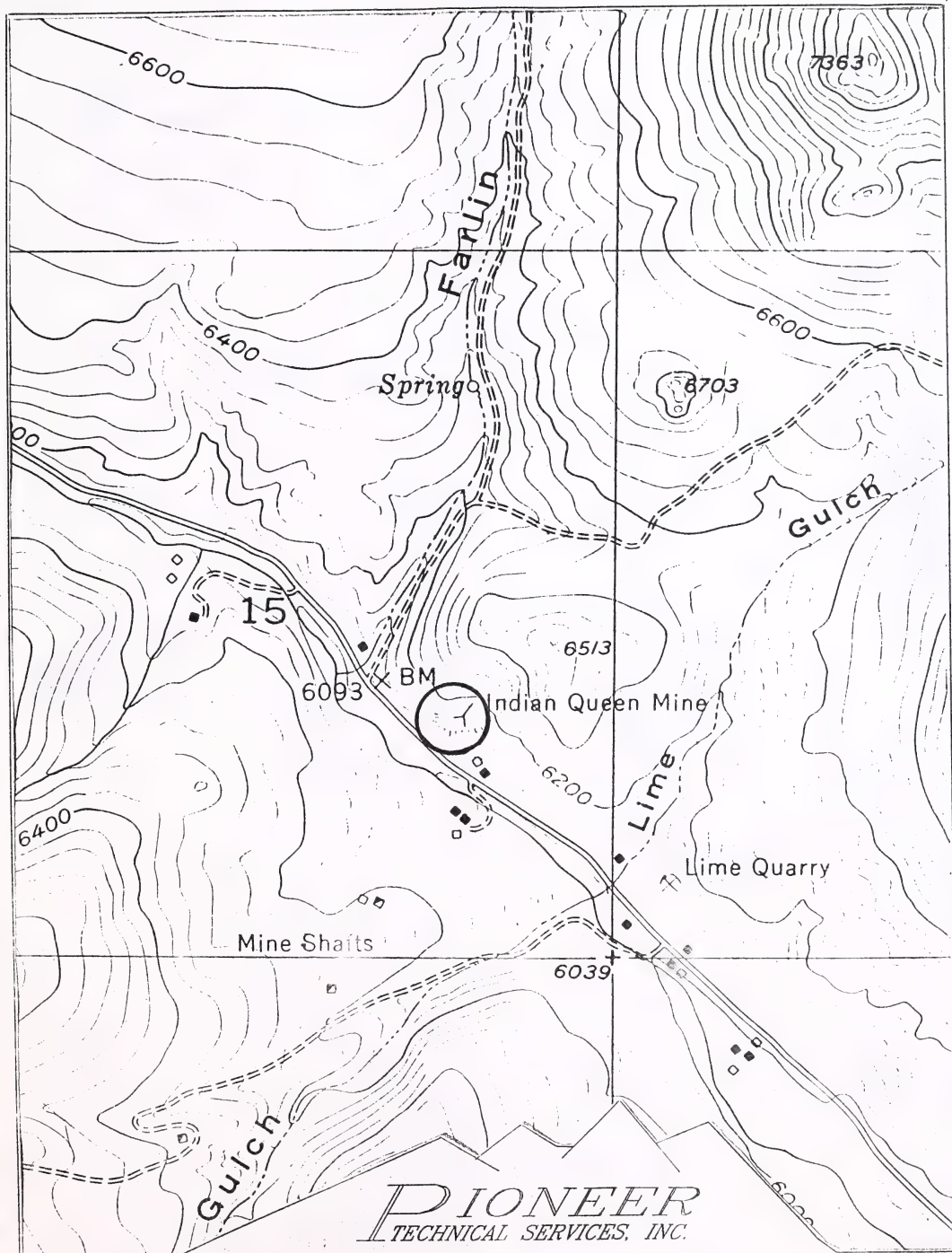
Montana Bureau of Mines and Geology  
Water Well Log Data

10/15/1993

Well No.	Location	Depth	Yield	Static Water Level
M:108549	05S 10W 09 CD	29.0	10.0	12.00
M:108550	05S 10W 15	65.0	0.0	0.00







**PIONEER**  
TECHNICAL SERVICES, INC.

INDIAN QUEEN, P.A. NO. 01-034

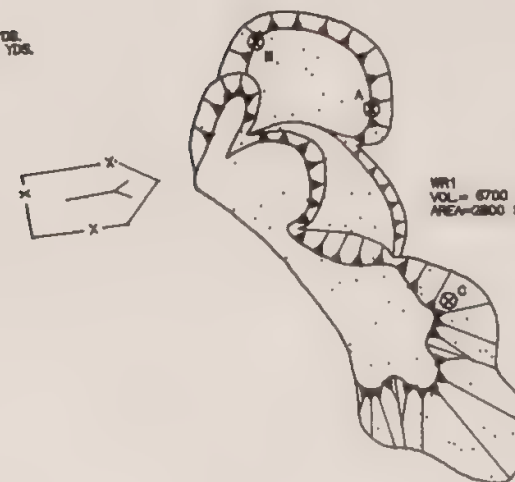
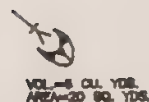
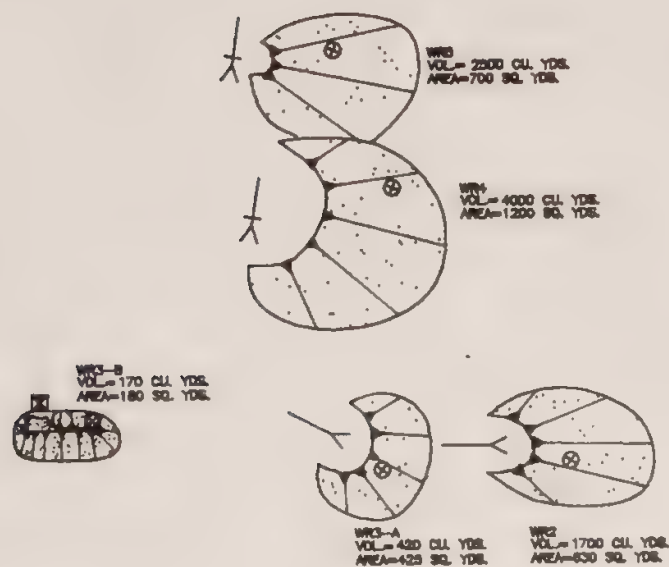
T05S, R01W, SECTION 15

SCALE: 1" = 1000'





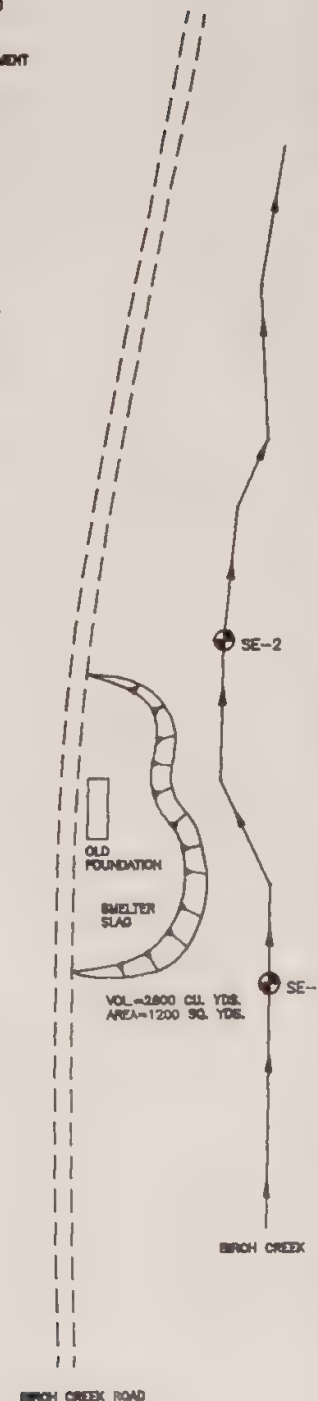
R I D G E  
L I N E



R I D G E  
L I N E

# LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	OPEN ADIT		CULVERT
	COLLAPSED ADIT		LIGHT (LIGHT POLE)
	OPEN SHAFT		UTILITY POLE
	COLLAPSED SHAFT		CENTERLINE MONUMENT
	EXCAVATION		DECIDUOUS TREE
	WHITE ROCK DUMP		CONIFEROUS TREE
	COLLAPSED TIMBERS		WOOD FENCE
	MAIN ROAD		WIRE FENCE
	PRIMITIVE ROAD		BUILDING
	RAILS		BARRIER POST
	DUMP		GATE
	XRF SAMPLE		EDGE OF ASPHALT
	WATER SAMPLE GROUND AND SURFACE		EDGE OF GRAVEL
			SLOPE DIRECTION
			DRAINAGE
			WATER WELL



MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

INDIAN QUEEN PA# 01-034  
BIRCH CREEK DISTRICT BEAVERHEAD COUNTY

PIONEER  
ENGINEERING CONSULTANTS

TDSH

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON

DRAWN JTP DATE 4 OCT 83  
DESIGNED TPR JOB NO. 93-17  
APPROVED INB F.B. NO.

SHEET NO.

01-034.DW 35 LEFTS



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A





# SOURCE INVENTORY FORM

SAMPLERS: Babits, Pierson, Belanger, Clark

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	PH SU (D/S)	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
WR-1A	WR	6,700	East portion of Dump 1	None	5.8 (D)	0.03	01-034-WR-2	06/15/93 1140	T-Metals, ABA
WR-1B	WR		Eastern most side of Dump 1	None	6.2 (D)	0.05	01-034-WR-1	06/15/93 1135	T-Metals, ABA
WR-1C	WR		Western portion of Dump 1	None	6.2 (D)	0.04			
WR-2	WR	1,700	Middle of south side of Dump 2	None	7.0 (D)	0.035	01-034-WR-4	06/15/93 1130	T-Metals, ABA
WR-3A	WR	420	Middle of south side of Dump 3A	None	6.9 (D)	0.035	01-034-WR-3	06/15/93 1130	T-Metals, ABA
WR-3B	WR	170	East side of Dump 3B	None	7.0 (D)	0.035			
WR-4	WR	4,000	East side of Dump 4	None	5.8 (D)	0.04			
WR-5	WR	2,500	Middle of south side of Dump 5	None	6.4 (D)	0.04			
SS-1	BERGRD	N/A	Background soil between Birch Creek and road and 300 feet west of slag	N/A	6.4 (D)	0.04	01-034-SS-1	06/15/93 1035	T-Metals
SG-1	Slag	2,600	South of road on creek	None	N/A	N/A	01-034-SG-1	06/15/93 1130	T-Metals

D-Direct Reading (Cavity Meter); S-Scattered Fast-Neutron Meter

Comments or deviations from SOPs: 01-034-WR-1 is grab of WR-1B. 01-034-WR-2 is composite of WR-1A and -1C. 01-034-WR-3 is composite of WR-3A and WR-5. 01-034-WR-4 is composite of WR-2, WR-3B, and WR-4.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes     , No X, Number:      Identification:     

Filled shafts: Yes     , No X, Number:      Identification:     

Seeps/Springs: Yes     , No X, Number:      Identification:     

Groundwater wells within 4 miles?: Yes X, No     ,  
Number of well logs: 5

Distance to nearest well used for drinking? Residences shown on topographic map at 500 feet and 2,000 feet to the southeast are unoccupied (Birch Creek Road houses); approx. 1/3 mile to the nearest well.

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite     , Probable     , Possible X, Unlikely     .

Waste rock does not appear to be in contact with alluvial aquifer. No adit discharge. Smelter waste is in stream channel with possible groundwater contact.

Other observations/notes: N/A

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No   , Name(s): Birch Creek flows southwest of site, but Birch Crk. Rd. separates dumps from creek. The slag is adjacent to Birch Crk. and separated from dumps by Birch Creek Road.

Dry streambeds: Yes   , No X, Name(s):   

Other surface water: Yes X, No   , Name(s)/Description: A drainage flows through (now dry) dumps, but when it hits Birch Creek Road it flows with the road's shape.

Waste materials within any floodplain: Yes X, No    Source ID(s): Slag

Approximate Flood frequency? X 1 yr,    10 yr,    100 yr

Estimated seasonal flow of stream(s) (cfs)? 119 during investigation  
High Flow: 125 cfs, Average Flow: 10 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet between slag and Birch Creek.

Surface water draining onto or through waste sources: Yes X, No   , Describe: A dry drainage is evident flowing through dump, but it hits Birch Creek Road.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Fishery, wetland

Observed erosional/sedimentation/stream turbidity problems? Yes   , No X, Distance downstream (ft)?    Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): N/A



**SAMPLERS:** Babits

[illegible]

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? None

Wetlands present: Yes X, No     , Describe: Very narrow stream side; willows.

Carbonate rocks/soils: Yes     , No X, Describe:                     

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10     ; 10-30     ; 30-100 X; 100-300     ; 300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ; Comments                     

Nearest residence(ft or miles)? Seasonal residence approx. 1/8 mile from site.

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



# ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Babits

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH /MODERATE/LOW/NONE)
WR-1	SO3	Partial	25,200	25,200	Yes	Moderate/Low
WR-2	SO3	Partial	5,670	5,670	Yes	Moderate/Low
WR-3A	SO3	Partial	3,825	3,825	Yes	Moderate/Low
WR-3B	SO3	Partial	1,620	1,620	Yes	Moderate/Low
WR-4	SO3	Partial	10,800	10,800	Yes	Moderate/Low
WR-5	SO3	Partial	6,300	6,300	Yes	Moderate/Low
slag	None	N/A	10,800	10,800	No	None

Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe:

Population within 1 mile: 1-10\_\_\_; 10-30 X; 30-100\_\_\_; 100-300\_\_\_;  
300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or greater\_\_\_;  
Comments

Evidence of recreational use on site: Yes X, No\_\_\_, Describe:\_\_\_\_\_  
Geology field trip in progress during investigation.

Accessibility - Fences, warning signs, closed roads? Warning signs  
posted at adits.

**Sensitive environments on-site or adjacent to site:**

State or National Parks - Yes     , No X, Comment                       
Wilderness Area - Yes     , No X, Comment                       
T&E Species Habitat - Yes     , No X, Comment                       
Bat Habitat - Yes X, No     , Comment Adits

Primary Drainage ; Secondary Drainage X ; No Information :

Riparian Habitat Quality - High X, Medium     , Low       
Wetlands Frontage - High X, Medium     , Low       
Fisheries Habitat and Species Classification - 4  
Sport Fishery Classification - 4

## G. SAFETY CHARACTERISTICS

### Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No     , Number 3, types and locations: Adits at WR-2, WR-3A, and one located 300 feet north of WR-1

Hazardous structures: Yes , No X , Number , types and locations:

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_, No X, Number\_\_\_,  
types and locations:

Unstable waste piles, impoundments, undercut banks: Yes X, No     ,  
Number 6 , types and locations: All dumps

Fire and/or Explosion hazards: Yes , No X , Explain:

## **Bibliography**

MBMG, Well Log Database, September 8, 1993.

MDSL/AMRB Files, Abandoned Mine Portal Inventory Form for the Indian Queen mine, Prepared by Daphne Digrindakis, August 20, 1986 and September 11, 1986.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for the Indian Queen mine, Prepared by Chen-Northern, July 28, 1993.

USGS, Topographic Map, Twin Adams Mountain, Montana, 7 1/2 minute Quadrangle, 1952.



LABORATORY ANALYTICAL DATA

INDIAN QUEEN  
PA NO. 01-034





Indian Queen PA# 01-034  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER-BABITS  
INVESTIGATION DATE: 06/15/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
01-034-SE-1	5	38.9	< 0.7	2.6	5.7	14	28400	< 0.019	237	< 3	9	< 5	29	NR
01-034-SE-2	448	91.8	7.9	15.4	11.1	4200	51900	< 0.029	1100	9	176	< 6	482	NR
01-034-SG-1	105	42.6	4.6	57.3	40	7130	155000	< 0.013	14300	19	47	< 3	873	NR
01-034-WR-1	759	9.1	7.4	20.2	17.1	15900	107000	0.169	2910	10	503	< 4	431	NR
01-034-WR-2	377	253	15.6	9.7	8.1	826	28000	0.822	1800	12	20	9	646	NR
01-034-WR-3	5210	79.1	11.5	74.6	48.2	13500	92100	0.215	1820	25	468	11	1490	NR
01-034-WR-4	1150	55.1	1.3	12.3	16.4	2070	88400	0.715	2320	7	96	< 3	244	NR
BACKGROUND	43	104	2.2	6.5	5.1	382	19200	0.085	582	3	56	< 4	117	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid Base/Accounting

FIELD ID	TOTAL SULFUR %	TOTAL SULFUR ACID BASE U/1000	NEUTRAL POTENT. U/1000	TOTAL ACID BASE POTENT. U/1000	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC SULFUR ACID BASE U/1000	PYRITIC SULFUR ACID BASE POTENT. U/1000
01-034-WR-1	0.47	14.7	15.2	0.49	0.49	<0.01	0	15.2
01-034-WR1-DUF	0.48	15	15.9	0.95	0.51	<0.01	0	15.9
01-034-WR-2	0.02	0.62	41	40.3	<0.01	<0.01	0	41
01-034-WR-3	0.06	1.87	49.3	47.4	0.01	<0.01	0	49.3
01-034-WR-4	0.02	0.62	37.2	36.5	<0.01	<0.01	0	37.2

LEGEND

SE1 - 20' upgradient of slag on Birch Creek.  
SE2 - 20' downgradient of slag on Birch Creek.  
SG1 - slag from East on road on creek.  
WR1 - Sample of subsample WR1B.  
WR2 - Composite of subsamples WR1A, 1B, and 1C.  
WR3 - Composite of subsamples WR3A and 5.  
WR4 - Composite of subsamples WR2, 3B, and 4.  
WR1-DUP - Duplicate of 01-034-WR-1.  
BACKGROUND - From Indian Queen (01-0340SS-1).



XRF ANALYSIS RESULTS

INDIAN QUEEN  
PA NO. 01-034



Mine Name: Indian Queen PA# 01-034  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CHI	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-034-SG-1		958	92094	86	36	11930	93206	381	3703	582	102	65
01-034-SS-1			24317.6	1768.74		999.242	30547.4		400.429	190.144	74.8244	353.495
01-034-WR1-A		13113.7	23674.7	2188.83		634.099	23655.2	381.404	602.771	970.995	53.1592	188.571
01-034-WR1-B		1298.26	64885.4			5017.96	146359		12750.4	776.999	1198.19	
01-034-WR1-C			13688.1	769.559		1925.16	65119.6	642.453	987.088	698.754	743.519	129.106
01-034-WR1-C1			14083.4	783.971		1879.9	65523		988.122	677.94	764.01	140.857
01-034-WR2-A			94269.4			4658.58	144100		1940.83	559.589	1888.9	
01-034-WR3-A			36033.5	793.36		2796.56	110156		13516.8	1598.23	2957.57	15.3009
01-034-WR3-B			117133			5063.59	154657		928.479	335.489	1765.51	
01-034-WR4-A			33213.3	1279.83		773.072	21125		203.059	158.723	154.092	217.63
01-034-WR5-A			25226.2	331.136		2248.77	82658.4	675.286	6434.64	776.867	3824.48	117.865
01-034-WR-1-COMP			58834.5			3971.03	144340		11193.8	545.254	1133.4	
01-034-WR-2-COMP			13253.6	1033.5		1724.49	38154.2		432.783	675.38	289.45	134.596
01-034-WR-3-COMP			31304.5	495.698	141.443	2477.05	101122		11880.5	1175.17	3334.95	41.9221
01-034-WR-4-COMP			75985	215.805		3195.08	98303.3	741.626	1053.42	273.214	993.566	90.3754
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-034-SG-1	14	55	61	11	17	170		14	114			
01-034-SS-1	167.241			48.8755	95.9413			521.042			11.1302	
01-034-WR1-A	14.912		8.02718		92.1456	128.19		556.713				
01-034-WR1-B	12.9081		133.689	398.822	37.4923	191.245			128.735			
01-034-WR1-C	89.7192	60.8596	68.4053		128.232			389.662	75.1355			
01-034-WR1-C1	79.946		69.0438		124.031			400.439				
01-034-WR2-A	14.364		69.0683	120.496	38.6075	230.712		23.9303	186.267			
01-034-WR3-A	43.5983		75.1923	562.328	67.118	163.717		116.741	90.0122		11.7135	
01-034-WR3-B			69.2457		20.3103	180.25			129.614			
01-034-WR4-A	115.319			31.6232	83.876			512.688				
01-034-WR5-A	59.7909		69.1784	100.571	141.988			343.519	79.9524			
01-034-WR-1-COMP	15.7595		145.823	271.831	30.3615			17.224	173.674			
01-034-WR-2-COMP	108.371		37.3745	81.9749	81.9749			497.057			8.84178	
01-034-WR-3-COMP	44.5544		76.3916	380.742	100.982			146.467			7.55737	
01-034-WR-4-COMP	44.9531		34.3408	49.9469	57.3436			295.409	100.713			

\* - Estimated Quantity  
\$ - Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

INDIAN QUEEN  
PA NO. 01-034



# AIMSS SCORESHEET

SITE NAME:

INDIAN QUEEN

PA NUMBER:

01-034

LINE NO.		GROUNDWATER PATHWAY	
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	20
3B		GW DEPTH	10
3C		POTENTIAL TO RELEASE	200
4		LIKELIHOOD SCORE	200
5	GW - WASTE CHAR.	CALCULATED SCORE	11.552
6		WELLS - 1 MI. x 2.5	5.0
7	GW - TARGETS	WELLS - 1 TO 4 MI	3
8		NEAREST WELL	5
9		TARGETS SCORE	13.0
10		GROUNDWATER SCORE	30035

LINE NO.		SURFACE WATER PATHWAY	
11		OBSERVED RELEASE	300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES	0
13A		CONTAINMENT	20
13B		DISTANCE TO SW	20
13C		POTENTIAL TO RELEASE	400
14		LIKELIHOOD SCORE	700
15	SW - WASTE CHAR.	CALCULATED SCORE	12.625
16		DRINKING WATER POP'N	0
17		IMPACTED DRAINAGE	0
18	SW - TARGETS	WETLANDS	10
19		FISHERY	0
20		RECREATION	5
21		IRRIGATION/STOCK	0
22		T & E SPECIES HABITAT	0
23		TARGETS SCORE	15
24		SURFACE WATER SCORE	132563

LINE NO.		AIR PATHWAY	
25		OBSERVED RELEASE	0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT	15
26B		DISTANCE TO POPULATION	20
26C		POTENTIAL TO RELEASE	300
27		LIKELIHOOD SCORE	300
28	AIR - WASTE CHAR.	CALCULATED SCORE	0.802
29		POPULATION - 4 MILES	30
30	AIR - TARGETS	NEAREST RESIDENCE	10
31		WETLANDS	0
32		PARKS / WILDERNESS	0
33		T & E SPECIES HABITAT	0
34		TARGETS SCORE	40
35		AIR PATHWAY SCORE	9624

LINE NO.		DIRECT CONTACT PATHWAY	
36		OBSERVED EXPOSURE	50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY	20
37B		DISTANCE TO POPULATION	20
37C		POTENTIAL EXPOSURE	400
38		LIKELIHOOD SCORE	450
39	D. C. WASTE CHAR.	CALCULATED SCORE	0.743
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE	10
41		NEAREST RESIDENCE	10
42		RECREATIONAL USE	5
43		TARGETS SCORE	25
44		DIRECT CONTACT SCORE	8359

45 TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE  
(LINES 10 + 24 + 35 + 44) / 100,000

1.81

LINE  
NO.

SITE NAME:  
PA NUMBER:

INDIAN QUEEN  
01-034

SITE SAFETY			
1	THREAT	ACCESSIBILITY	20
2		OPEN SHAFTS	100 EA.
3		OPEN ADITS	50 EA.
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.
5		HAZ. STRUCTURES	40 EA.
6		EXPLOSIVES	0
7		HAZ. MATERIALS	0
8		HAZARDS SCORE	SUM LINES 2 - 7
9		POPULATION - 1 MILE	150
10	TARGETS	NEAREST RESIDENCE	10
11		RECREATIONAL USE	10
12		TARGETS SCORE	SUM LINES 9 - 11
13		SITE SAFETY SCORE	(LINES 1 x 8 x 12) / 1,000
			75.00





01-034, #14: Adit east of R 9-10



01-034, #16: WR-2



01-034, #13: Adit R 9-10



01-034, #15: Adit down gradient of R 9-10





01-034, #18: WR-3



01-034, #20: WR-3B



01-034, #17: Shaft #3



01-034, #19: Adit #4





01-034, #22: Trench



01-034, #24: WR-4 and WR-5



01-034, #21: Shaft #2



01-034, #23: Adit





01-034, #26: Adit R 9-10



01-034, #27: Smelting site



01-034, #25: Adit





MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: OLD ELKHORN

PA#: 01-169

Date: September 15, 1993 Time: 0930

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Pierson, TD&H  
\_\_\_\_\_  
\_\_\_\_\_

Visitors: Several groups of tourists viewing the  
ghost town and mill  
\_\_\_\_\_

Weather/Seasonality Observations: Partly cloudy; scattered  
showers; cool; calm; approx. 50°F; cool, wet spring and summer.  
\_\_\_\_\_  
\_\_\_\_\_

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #1: Mill building;  
#2: Barrel and stream; #3: Mill building; #28: Adit, GW-1 sample  
location; #29: WR-1, facing south; #30: WR-1, facing north; #31:  
Loadout and settling pond; #32: SW-3 sample location, discharge  
from settling pond; #33: SW-4 sample location upgradient; #34: Pond  
for Adit discharge; #35: SW-2 sample location; #36: SW-1 sample  
location downgradient. Video Tape No. 6  
\_\_\_\_\_  
\_\_\_\_\_

General Comments/Observations (not covered specifically in attached Inventory Forms): N/A  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Other Hazardous Materials/Substances Present: N/A  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

General Comments on Potential Remedial Alternatives: Study AMD  
problem; runoff/runoff control, grade, amend, and revegetate.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): OLD ELKHORN PA#: 01-169

Legal Description: T 4S ; R 12W ; Sec. 14 , NE1/4 NE1/4 1/4

County: BEAVERHEAD Mining District: ELKHORN

Latitude: N 45° 29' 23" Longitude: W 113° 02' 18"

Primary Drainage Basin and Code: Wise River/10020004

Secondary Drainage Basin: Elkhorn Creek

USGS Quadrangle map name(s): Elkhorn Hot Springs

Mine Type/Commodities: Hardrock/Gold, Silver, Copper, Lead, Zinc

Activity Status: Active ☐ , Inactive/Exploration ☐ , Abandoned ☒ .

Ownership status: Known ☒ N ☐ ; private/public? Public

Owner, Agent, or Contact (Include address and phone when available): U.S. Forest Service

Relationship to other mines/sites in the area/district: None known

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? Elkhorn Mill was slated for reclamation by the USFS during the 1993 construction season.

General site features: Elevation 7560' , Slope 0°-35° ,  
Aspect East-Northeast

Land use: Mining ☐ , Recreational ☒ , Residential ☐ , Urban ☐ ,  
Agricultural ☐ , Other (Specify)

Area of disturbed/unvegetated lands? Approx. 1.5 acres.  
Dimensions:

Predominant vegetation types: Lodgepole pine, Douglas fir, spruce, potutilla, willows

Access: roads - good ☐ , poor ☐ , 4wd ☐ , trail ☒ .  
Other logistical considerations (proximity to other sites). USFS road closure approximately 1/2 mile below site.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). The mine is located in the Elkhorn Creek  
drainage basin, a major tributary to Wise River. The Elkhorn  
district is situated in the middle of a quartz monzonite intrusive  
mass.

Mining/milling history, ore type/tenor, host rock, gangue: The old  
Elkhorn claim was initially discovered by Preston Sheldon in 1872.  
Ore assayed 300 ounces of silver per ton. Ore consists of quartz  
with pyrite carrying silver and copper. The veins contain  
chalcopyrite, galena, sphalerite and chalcocite.

#### Mine Operation?

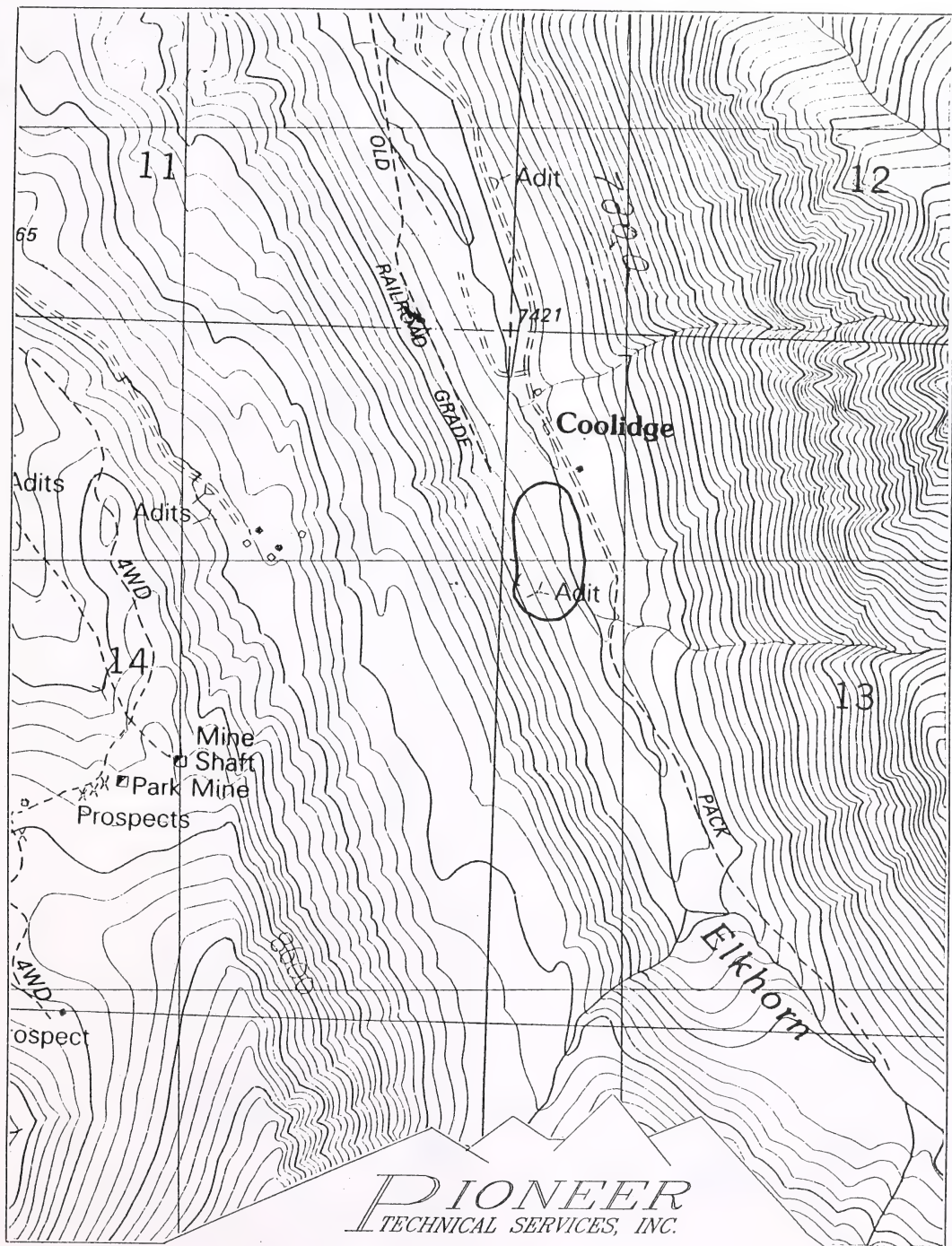
Shafts - Yes ☐, No ☒, #     , Comment                       
Adits - Yes ☒, No ☐, # 1, Comment Open  
Pits - Yes ☐, No ☒, #     , Comment                       
Placers - Yes ☐, No ☒, #     , Comment                       
Other - Yes ☐, No ☒, #     , Comment                     

Mill Operation? Yes ☐, No ☒. If yes answer the next three  
questions:

Period(s) of Operation: N/A

Origin of Ore Milled - Custom Mill ☐ Dedicated Mill ☐; Number and  
names of mines that supplied mill feed: Ore from the Old Elkhorn  
and other local mines was milled at the Elkhorn Mill approximately  
1/4 mile north of the mine.

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
N/A



*PIONEER*  
TECHNICAL SERVICES, INC.

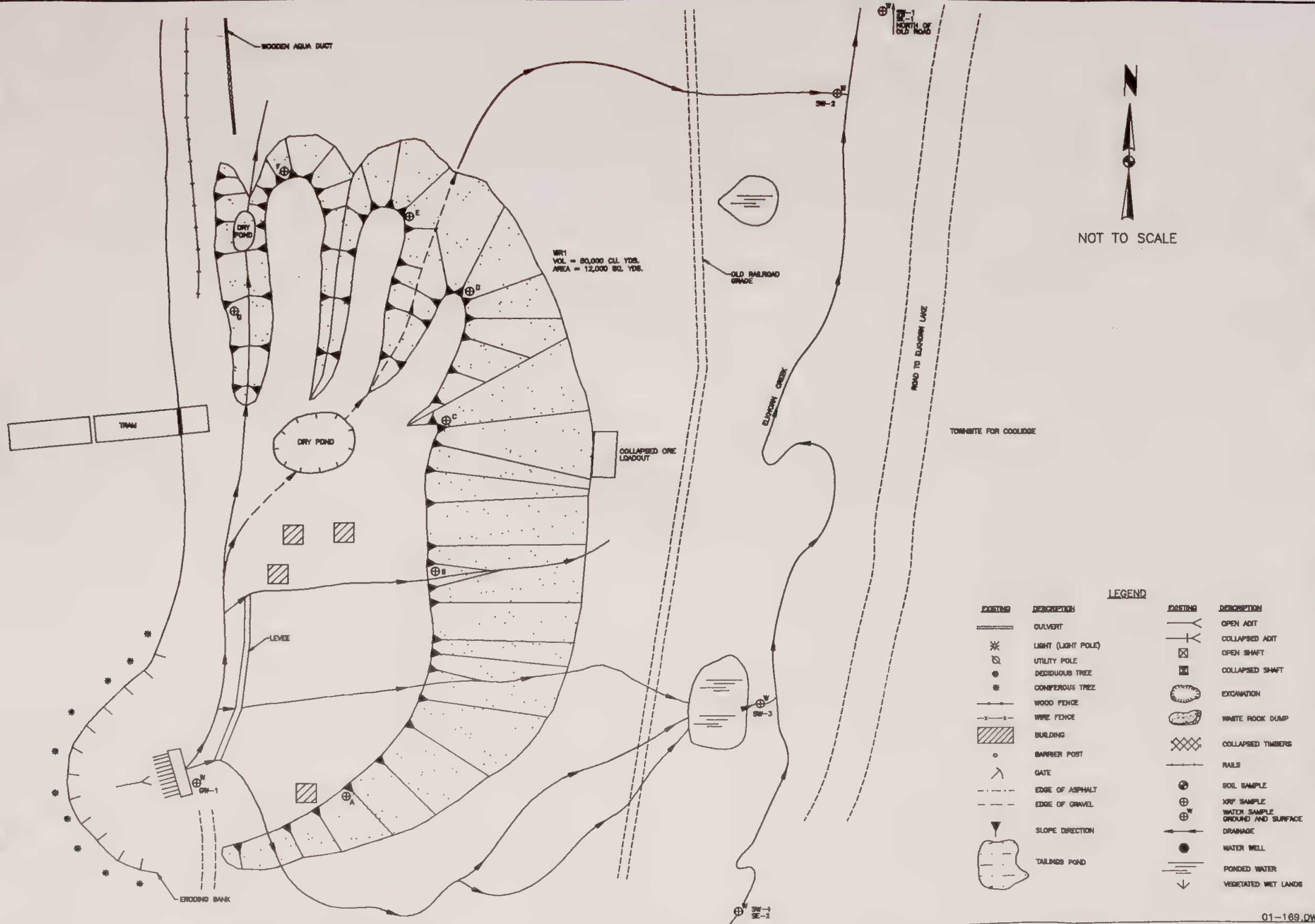
OLD ELKHORN, P.A. NO. 01-169

T04S, R12W, SECTION 14

SCALE: 1" = 1000'







MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY  
OLD ELKHORN PA# 01-169  
ELKHORN DISTRICT BEAVERHEAD COUNTY

PIONEER  
ENGINEERING CONSULTANTS  
THOMAS, DEAN & HOSKINS INC.  
GREAT FALLS-BOZEMAN-KALISPELL  
SPokane MONTANA WASHINGTON

DRAWN: CAN DATE: 12/1/83  
DESIGNED: IPR JOB NO.: 83-17  
APPROVED: MJB F.B. NO.:

01-169.DWG SHEETS





## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): \_\_\_\_\_  
N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): \_\_\_\_\_  
N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): \_\_\_\_\_  
N/A

Comments on potential for mitigation: \_\_\_\_\_  
N/A



# SOURCE INVENTORY FORM

SAMPLERS: Bullock, Pierson

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
WR-1A	WR	50,000	South end of dump; brown sand	None	7.0 (D)	0.05	01-169-WR-1	09/16/93 1445	T-Metals, ABA
WR-1B	WR		East side of dump; light brown sand	None	6.8 (D)	0.04			
WR-1C	WR		Northeast side of dump; white/orange silty sand	None	<3.5 (D)	0.06	01-169-WR-2	09/16/93 1455	T-Metals, ABA
WR-1D	WR		Northeast end of dump; gray silty sand	None	4.3 (D)	0.06			
WR-1E	WR		North central finger; red/gray silty sand	None	4.6 (D)	0.05			
WR-1F	WR		North western finger; yellow silty sand	None	< 3.5 (D)	0.06			
WR-1G	WR		Railroad grade; yellow silty sand	None	3.8 (D)	0.07			
SS-1	BKGRND	N/A	Background soil southwest and uphill from WR-1.	None	N/A	N/A	01-169-SS-1	09/15/93 1215	T-Metals

\* Direct reading (Kilovolt Meter); Subtracted Rate (Cesium Meter)

Comments or deviations from SOPs: 01-169-WR-1 is composite of WR-1A and WR-1B. 01-169-WR-2 is composite of WR-1C through -1G.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map.

Flowing adits: Yes X, No   , Number:    Identification: Adit #1

Filled shafts: Yes   , No X, Number:    Identification:   

Seeps/Springs: Yes X, No   , Number: 2 Identification: Seeps emanating from northern toe of waste rock dump characterized by SW-2.

Groundwater wells within 4 miles?: Yes X, No   ;  
Number of well logs: 7

Distance to nearest well used for drinking? 3 miles to USFS campground

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite   , Probable X, Possible   , Unlikely   .

Adit discharge is low pH with elevated metals levels.

Other observations/notes: N/A

SAMPLERS: Bullock

[illegible]

**TOW:** Retained (R) or Measured (M) from adlt, abt, seep or spring?

[illegible]



### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No    , Name(s): Elkhorn Creek

Dry streambeds: Yes    , No X, Name(s):    

Other surface water: Yes X, No    , Name(s)/Description: Adit discharge flows down into Elkhorn Creek.

Waste materials within any floodplain: Yes    , No X Source ID(s):    

Approximate Flood frequency?     1 yr,     10 yr,     100 yr

Estimated seasonal flow of stream(s) (cfs)? 7 during investigation

High Flow: Approx. 50 cfs, Average Flow: Approx. 6 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet; adit discharge flows over and through WR-1.

Surface water draining onto or through waste sources: Yes X, No    , Describe: Adit discharge flows over and through WR-1.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Fishery, T&E, irrigation, stock watering, wetlands

Observed erosional/sedimentation/stream turbidity problems? Yes X, No    , Distance downstream (ft)? 500 Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Iron-staining of rocks for approximately 500 feet is occurring, although mill downgradient appears to cause greater impacts.



**SAMPLERS:** Bullock, Pierson

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993): NM = Not measured due to meter malfunction.

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? 10 to 20 acres of meadow/wetlands between mine and mill.

Wetlands present: Yes X, No     , Describe: Elkhorn Creek was channelized around the mill tailings leaving behind wetlands in the former (natural) stream channel.

Carbonate rocks/soils: Yes     , No X, Describe:     

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 X; 10-30     ; 30-100     ; 100-300     ; 300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ; Comments     

Nearest residence(ft or miles)? Approx. 4 miles

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none

**SAMPLERS:** Bullock, Pierson

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe: \_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments None

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: Heavy  
recreation; hikers to Coolidge ghost town and Elkhorn Mill.

Accessibility - Fences, warning signs, closed roads? Warning signs on  
adit; closed road, but high tourist use in this area.

Sensitive environments on-site or adjacent to site:

State or National Parks - Yes\_\_\_\_, No X, Comment\_\_\_\_  
Wilderness Area - Yes\_\_\_\_, No X, Comment\_\_\_\_  
T&E Species Habitat - Yes\_\_\_\_, No X, Comment\_\_\_\_  
Bat Habitat - Yes\_\_\_\_, No X, Comment\_\_\_\_

Primary Drainage\_\_\_\_; Secondary Drainage X; No Information\_\_\_\_:

Riparian Habitat Quality - High X, Medium\_\_\_\_, Low\_\_\_\_  
Wetlands Frontage - High X, Medium\_\_\_\_, Low\_\_\_\_  
Fisheries Habitat and Species Classification - 4  
Sport Fishery Classification - 4

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No\_\_\_\_, Number 1, types and locations:\_\_\_\_  
Adit #1

Hazardous structures: Yes X, No\_\_\_\_, Number 2, types and locations:\_\_\_\_  
Small sheds

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_,  
types and locations:\_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes X, No\_\_\_\_,  
Number 1, types and locations: WR-1 is overly steep and eroding.

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain:\_\_\_\_\_

## Bibliography

MBMG, Mines and Mineral Deposits (Except Fuels), Beaverhead County, Montana, Bulletin 85, Author Unknown, April 1972.

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Old Elkhorn, Prepared by Northern Engineering and Testing, July 29, 1987.

USGS, Mining Districts of the Dillon Quadrangle, Montana, and Adjacent Areas, Bulletin 574, Written by Alexander N. Winchell, 1914, pp. 168-170.

USGS, Topographic Map, Elkhorn Hot Springs, Montana, 7 1/2 minute Quadrangle, 1988.







LABORATORY ANALYTICAL DATA

OLD ELKHORN  
PA NO. 01-169



Old Elkhorn PA# 01-169  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 09/15/93

# SOLID MATRIX ANALYSES

Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
01-169-SE-1	7.09 J	35.4 J	0.9 U	2.37	1.22 U	52.9	6980 JX	0.031 U	392	4.58	6.68	6.18 UJ	134 J	NR
01-169-SE-2	4.02 U	13.2 J	0.8 U	1.09	1.05 U	1.83	2820 JX	0.030 U	251	4	5.51 UJ	5.32 UJ	19 J	NR
01-169-WR-1	17.1 J	121 J	0.9 U	4.59	1.18 U	189	14500 JX	1.59 J	393	5.16	22.2	5.99 UJ	123 J	NR
01-169-WR-2	121 J	55.1 J	4.8 J	4.19	1.25 U	573	18200 JX	1.75 J	1590	4.13	717	9.92 J	821 J	NR
BACKGROUND	12.3 J	182 J	1.1 U	6.54	4.37 J	17.8	12300 JX	0.051 J	1170	8.28	15.8	7.35 UJ	158 J	NR

U - Not Detected J - Estimated Quantity X - Outlier for Accuracy or Precision; NR - Not Requested

## Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID/BASE POTENTIAL	NEUTRAL POTENTIAL	SULFUR ACID/BASE POTENTIAL	SULFATE %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID/BASE POTENTIAL	SULFUR ACID/BASE POTENTIAL
01-169-WR-1	0.26	8.12	33.1	25	<0.01	0.09	0.17	2.81	30.3
01-169-WR-2	1.07	33.4	7.61	-25	0.38	0.11	0.58	3.44	4.18

# WATER MATRIX ANALYSES

Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
01-169-GW-1	19.9	5.03	17.8	6.47	6.24 U	745	3590	0.12 U	3590	10.9 U	107	31.7 U	3630	99.3
01-169-SW-1	1.12 U	11.7	4.59 U	5 U	6.24 U	23.6	32.2	0.12 U	71.1	10.9 U	1.88	31.7 U	159	22.8
01-169-SW-2	1.18	8.2	49.2	10	6.24 U	2930	926	0.12 U	9490	14.7	57.5	50.8	11100	225
01-169-SW-3	1.26	11.8	16.5	6.33	6.24 U	700	193	0.12 U	3210	10.9 U	25	31.7 U	3500	102
01-169-SW-4	1.12 U	10.1	4.59 U	5 U	6.24 U	2.33 U	30.1	0.12 U	7.47	10.9 U	0.94 U	35.3	8.71 U	17.3

U - Not Detected J - Estimated Quantity X - Outlier for Accuracy or Precision; NR - Not Requested

## Wet Chemistry

Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
01-169-GW-1	238	< 5	124	0.09	NR
01-169-SW-1	67	< 5	12	0.07	NR
01-169-SW-2	542	< 5	297	0.05	NR
01-169-SW-3	204	< 5	131	< 0.05	NR
01-169-SW-4	42	< 5	5	0.05	NR

## LEGEND

- SE1 - Downgradient Elkhorn Creek near old bridge.  
SE2 - Upgradient Elkhorn Creek.  
WR1 - Composite of samples WR1A and 1B.  
WR2 - Composite of samples WR1C through 1G.  
BACKGROUND - From the Old Elkhorn Mine (01-169-SS-1).
- GW1 - Adit #1 discharge.  
SW1 - Same as sample SE1.  
SW2 - Seepage from North end of waste rock dump 1 at PPE to Elkhorn Creek.  
SW3 - Adit discharge at PPE to Elkhorn Creek.  
SW4 - Upgradient Elkhorn Creek.



**XRF ANALYSIS RESULTS**

**OLD ELKHORN  
PA NO. 01-169**





XRF SAMPLE ID	Cr/Al	K	Ca	Ti	Cr/LO	Mn	Fe	Co	Cu	Zn	As	Sr
001-169-WR1-A	22042.4	9460.18	1262.8			659.687 *	26504.7		143.394 *	155.672	44.2195 *	311.32
001-169-WR1-B	21989.7	18482	966.512			377.977 *	14629.4		27.7579 *	57.7579 *	27.7861 *	368.815
001-169-WR1-C		16085.4	1570.84			363.676 *	31921		106.697 *	68.6	85.8502 *	400.191
001-169-WR1-D		12372	1071.9			9653.32	20338.4		501.263	1626.49		243.194
001-169-WR1-E		14423.1	1009.15			2395.43	48350.7		1748.8	1534.67	238.188	340.729
001-169-WR1-E-DUP		3104.99	1223.87				16247.3		387.327	690.732	101.902 *	
001-169-WR1-G		3972.1	1404.54				20637.6		588.381	427.539	204.743 *	213.167
001-169-WR1-COMP		19604.3	1122.54			847.88 *	20637.1		109.02 *	106.314 *	53.2759 *	347.608
001-169-WR-2-COMP		9089.32	1156.01			2744.05	23888.6		530.497	751.632	83.5586 *	253.788

\* - Estimated Quantity  
\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

OLD ELKHORN  
PA NO. 01-169



# AIMSS SCORESHEET

SITE NAME:  
PA NUMBER:

OLD ELKHORN  
01-169

LINE NO.			
<b>GROUNDWATER PATHWAY</b>			
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	20
3B		GW DEPTH	20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
6		WELLS - 1 MI. x 2.5	44.384
7	GW - TARGETS	WELLS - 1 TO 4 MI	0.0
8		NEAREST WELL	7
9		TARGETS SCORE	LINES 6 + 7 + 8
10		GROUNDWATER SCORE	LINES 4 x 5 x 9
<b>SURFACE WATER PATHWAY</b>			
11		OBSERVED RELEASE	300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES	100
13A		CONTAINMENT	20
13B		DISTANCE TO SW	20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
16		DRINKING WATER POP'N	49.778
17	SW - TARGETS	IMPACTED DRAINAGE	0
18		WETLANDS	1
19		FISHERY	10
20		RECREATION	1
21		IRRIGATION/STOCK	5
22		T & E SPECIES HABITAT	2
23		TARGETS SCORE	0
24		SURFACE WATER SCORE	SUM LINES 16 - 22
			LINES 14 x 15 x 23
<b>AIR PATHWAY</b>			
25		OBSERVED RELEASE	0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT	10
26B		DISTANCE TO POPULATION	5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B
27		LIKELIHOOD SCORE	LINES 25 + 26C
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
29		POPULATION - 4 MILES	0.092
30	AIR - TARGETS	NEAREST RESIDENCE	1
31		WETLANDS	0
32		PARKS / WILDERNESS	10
33		T & E SPECIES HABITAT	0
34		TARGETS SCORE	0
35		AIR PATHWAY SCORE	SUM LINES 29 - 33
			LINES 27 x 28 x 34
<b>DIRECT CONTACT PATHWAY</b>			
36		OBSERVED EXPOSURE	50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY	10
37B		DISTANCE TO POPULATION	5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B
38		LIKELIHOOD SCORE	LINES 36 + 37C
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE	0.083
41		NEAREST RESIDENCE	0
42		RECREATIONAL USE	0
43		TARGETS SCORE	10
44		DIRECT CONTACT SCORE	SUM LINES 40 - 42
			LINES 38 x 39 x 43
45	TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE		8.81
	(LINES 10 + 24 + 35 + 44) / 100,000		

SITE NAME:  
PA NUMBER:

OLD ELKHORN  
01-169

LINE  
NO.

**SITE SAFETY**

1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	50
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	80
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	130
9		POPULATION - 1 MILE		0
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		10
12		TARGETS SCORE	SUM LINES 9 - 11	10
13		SITE SAFETY SCORE	(LINES 1 x 8 x 12) / 1,000	13.00

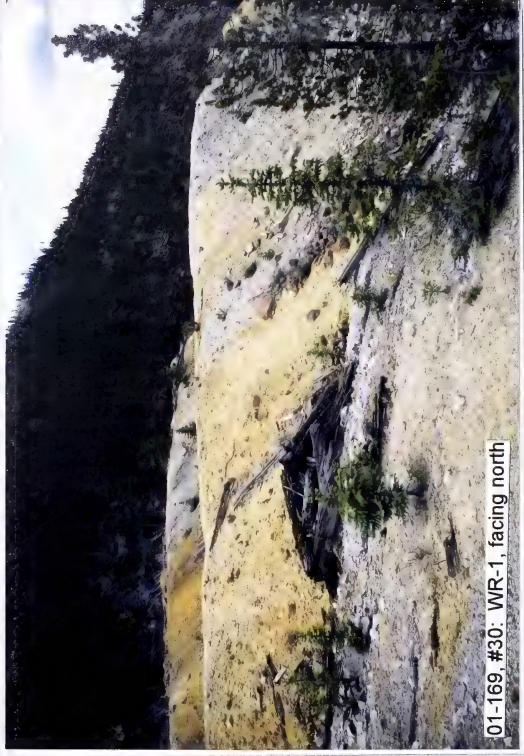








01-169, #29: WR-1, facing south



01-169, #30: WR-1, facing north



01-169, #31: Loadout and settling pond

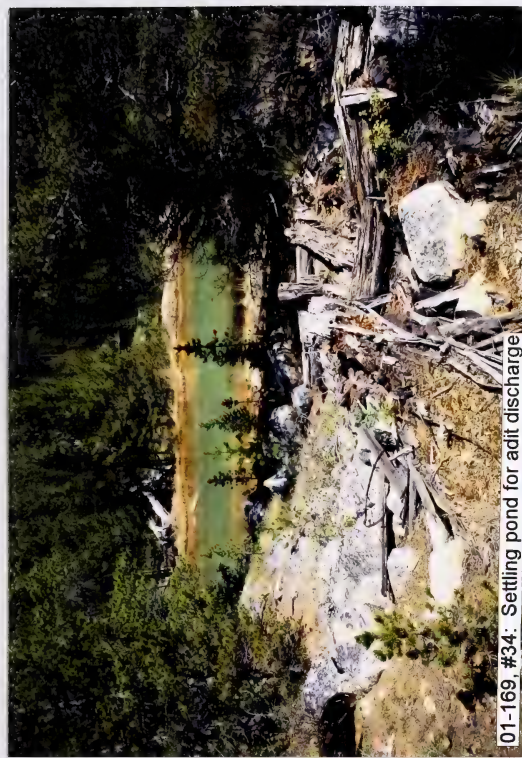


01-169, #32: Discharge from settling pond; SW-3 sample location





01-169, #33: SW-4 sample location (upgradient)



01-169, #34: Settling pond for adit discharge



01-169, #35: SW-2 sample location



01-169, #36: SW-1 sample location (downgradient)









MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: ERMONT MILL PA#: 01-005

Date: June 14, 1993 Time: 1100-1500

Field Team Leader: Babits, Pioneer

Sampling Personnel: Belanger, Lasher, Clark;  
Pioneer  
Pierson; TD&H

Visitors: None

Weather/Seasonality Observations: Warm (55°F); partly cloudy;  
slight breeze (< 5 mph).

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): 01-005 - #5,#6:  
Tailings Impoundment; #7: Background soil location; #9: Up drainage  
to south; #12: Adit at metal building, northwest of tailings.  
01-112 - #1: WR-5; #2: Shaft #1; #3: WR-1; #32: Shaft #3; #33: WR-  
3; #34: WR-2 and adit; #35: WR-2; #36: Shaft #4; #37: Shaft #5.  
01-113 - #4,#8: HMO; #10: Shaft #1; #11: Adit #1.  
Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms):  
Access to sites by truck. Three PA Nos. were investigated: Ermont  
Mill (01-005), Ermont No. 19 (01-112), and Ermont No. 2 (01-113).  
Ermont No. 19 has five shafts all with grates and small piles  
associated with the site. Ermont No. 2 is just an open pit and no  
samples were taken at the mine site.  
Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Move tailings  
from Ermont Mill to fill in the pit at Ermont No. 2. Recontour and  
revegetate small dumps at Ermont No. 19.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): ERMONT MILL PA#: 01-005

Legal Description: T 6S ; R 11W ; Sec. 35 , NW1/4SE 1/4 1/4

County: BEAVERHEAD Mining District: ERMONT

Latitude: N 45° 16' 05" Longitude: W 112° 54' 50"

Primary Drainage Basin and Code: Beaverhead River/10020002

Secondary Drainage Basin: Ermont Gulch

USGS Quadrangle map name(s): Ermont

Mine Type/Commodities: Hardrock/Silver, Gold, Copper

Activity Status: Active , Inactive/Exploration , Abandoned X .

Ownership status: Known YX N ; private/public? Public

Owner, Agent, or Contact (Include address and phone when available): BLM; Joseph Wellborn, 11755 Hwy. 324, Dillon, MT 59725.

Relationship to other mines/sites in the area/district: Other  
mines are located in the area.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? One adit has been closed possibly by  
MDSL at the Ermont Mill. Shafts have been grated by MDSL at Ermont  
No. 19. All three sites have been listed under CECRA.

General site features: Elevation 6400', Mill; 6540', No. 19;  
6500', No. 2 , Slope 10°, Mill; 9°, No. 19 and No. 2 ,  
Aspect South and West, Mill; East and West, No. 19; East, No. 2

Land use: Mining , Recreational , Residential , Urban ,  
Agricultural X , Other(Specify)

Area of disturbed/unvegetated lands? 11.5 acres.  
Dimensions: 0.5 acres at Ermont No. 19; approx. 2 acres at Ermont  
No. 2

Predominant vegetation types: Sage and grasses at the mill; sage  
at No. 19; and, none at No. 2.

Access: roads - good X , poor , 4wd , trail .  
Other logistical considerations (proximity to other sites).

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are no well logs within a 1 mile radius of  
the three sites.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). The mill lies in the dry intermittent  
drainage, Ermont Gulch, which flows southeast away from the site.  
Water flowing in Ermont Gulch would flow into Rattlesnake Creek  
approx. 1.5 miles away. Shallow groundwater is estimated to be at  
least 100 feet below the ground surface. Ermont No. 19 lies on the  
west side of an unnamed dry tributary to Ermont Gulch and on the  
east side of another unnamed dry tributary to Ermont Gulch. Both  
tributaries would carry any water leaving the site south to Ermont  
Gulch. Ermont No. 2 lies on the north side of Ermont Gulch. The  
sites are underlain by Jefferson dolomite intruded by an andesite  
sill.

Mining/milling history, ore type/tenor, host rock, gangue: No. 19  
and No. 2 operated from 1926 to 1963, with the mill operating from  
1936 to 1948. Production for all three properties was 189,649 tons  
of ore which yielded 4,789 lbs. Cu, 6,999 oz. Ag, and 41,255 oz.  
Au.

Mine Operation?

Shafts - Yes X, No    , # 6, Comment No. 19: 3 grated, 2 open;  
No. 2: 1 open

Adits - Yes X, No    , # 2, Comment Mill: 1 closed; No. 2: 1  
open

Pits - Yes X, No    , # 1, Comment No. 2

Placers - Yes    , No X, #    , Comment    

Other - Yes    , No X, #    , Comment    

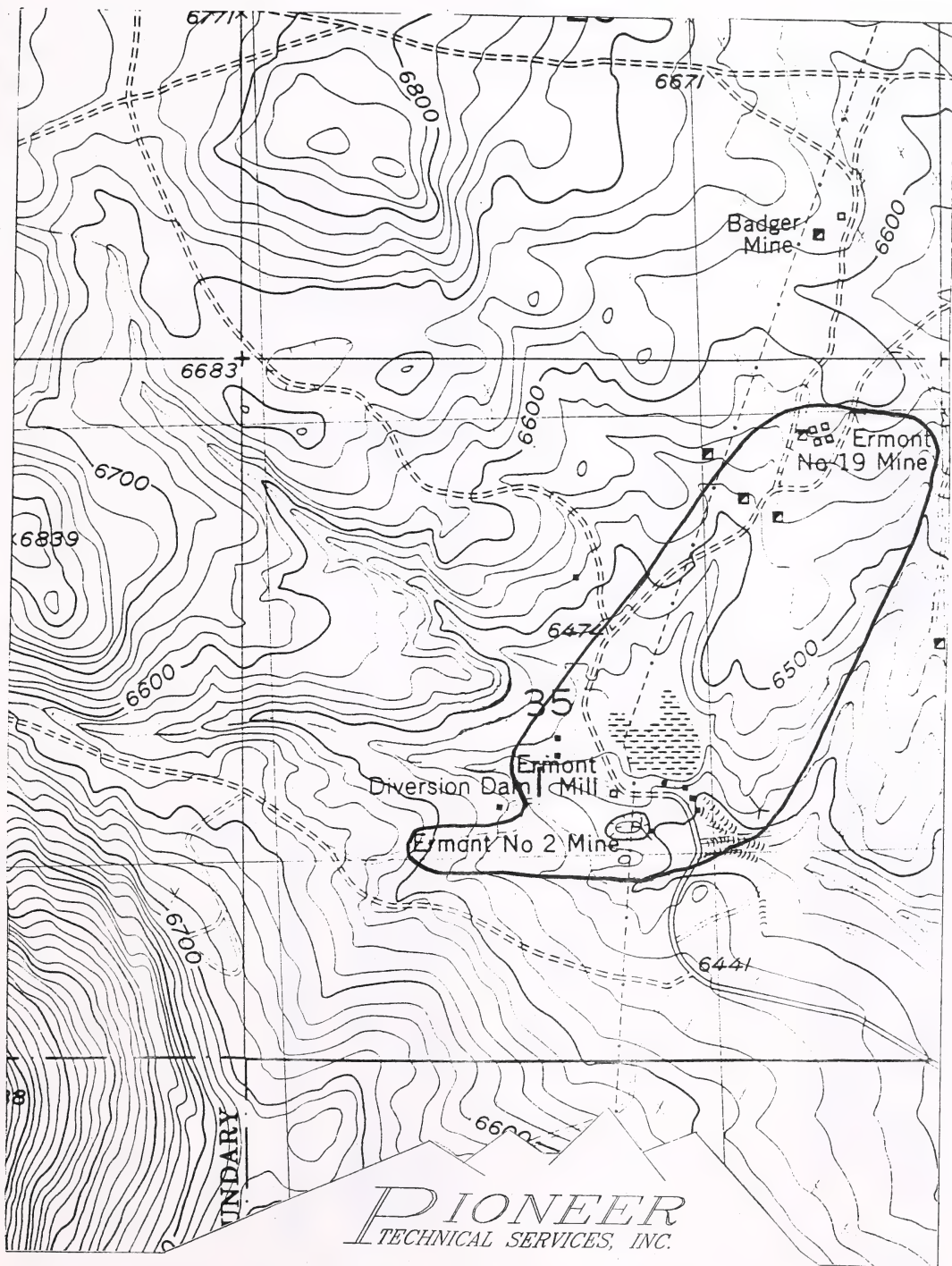
Mill Operation? Yes X, No    . If yes answer the next three  
questions:

Period(s) of Operation: 1936 to 1948

Origin of Ore Milled - Custom Mill     Dedicated Mill    ; Number and  
names of mines that supplied mill feed: Ermont No. 19, Ermont No.  
2, and Badger

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
100-ton cyanide mill





**PIONEER**  
TECHNICAL SERVICES, INC.

ERMONT MILL, P.A. NO. 01-005

T06S. R11W, SECTION 35

SCALE: 1" = 1000'





- |  |                     |  |                    |
|--|---------------------|--|--------------------|
|  | <b>LEGEND</b>       |  | <b>LEGEND</b>      |
|  | CULVERT             |  | OPEN ADIT          |
|  | LIGHT (LIGHT POLE)  |  | COLLAPSED ADIT     |
|  | UTILITY POLE        |  | OPEN SHAFT         |
|  | CENTERLINE MONUMENT |  | COLLAPSED SHAFT    |
|  | DECIDUOUS TREE      |  | EXCAVATION         |
|  | CONIFEROUS TREE     |  | WHITE ROCK CLUMP   |
|  | WOOD FENCE          |  | COLLAPSED TIMBER   |
|  | WIRE FENCE          |  | RAILS              |
|  | BUILDING            |  | SOIL SAMPLE        |
|  | BARBER POST         |  | ICE SAMPLE         |
|  | GAGE                |  | WATER SAMPLE       |
|  | EDGE OF ASPHALT     |  | GROUND AND SURFACE |
|  | EDGE OF GRAVEL      |  | DRAINAGE           |
|  | SLOPE DIRECTION     |  | WATER WELL         |



MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY  
ERMONT MILL & MINES PA# 01-005  
ERMONT DISTRICT BEAVERHEAD COUNTY

DATE 5 OCT 83  
JTE NO 83-17  
DESIGNED BY JTE  
APPROVED BY JTE  
THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA  
SPOKANE WASHINGTON

PIONEER  
TBSH

SHEET NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution(approximate % sand, silt, & clay):  
Fine sands and silts

Determine tailings impoundment depth and describe stratification of the tailings if observable(based on texture and color): Range of 0 to 30 feet deep.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Wet with standing water.

Describe condition of the tailings impoundment(Note condition of dams or structures, location of breaches): Poor; breach in middle.

Comments on potential for mitigation: Could fit in huge pit.



# SOURCE INVENTORY FORM

SAMPLERS: Pierson, Lasher; Babits, Belanger

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
TP-1A-A	TAIL	200,000	Northeast side of pond; 0-4.5', sandy	Rotting Impoundment	8.04 (S)	0.06	01-005-TP-1	06/14/93 1540	T-Metals, ABA
TP-1A-B	TAIL		Northeast side of pond; 4.5-9', clay	Rotting Impoundment	8.55 (S)	0.05			
TP-1A-C	TAIL		Northeast side of pond; 9-15', sandy clay	Rotting Impoundment	8.73 (S)	0.04			
TP-1B-A	TAIL		South central of pond; 0-3'	Rotting Impoundment	8.0 (S)	0.04			
TP-1B-B	TAIL		South central of pond; 3-6'	Rotting Impoundment	8.59 (S)	0.04			
TP-1B-C	TAIL		South central of pond; 6-9'	Rotting Impoundment	8.25 (S)	0.03			
TP-1B-D	TAIL		South central of pond; 9-12'	Rotting Impoundment	7.24 (S)	0.05			
TP-1B-E	TAIL		South central of pond; 12-15'	Rotting Impoundment	6.91 (S)	0.04			
WR-1	WR	30	Furthest west	None	6.8 (D)	0.03	01-112-WR-1	06/14/93 1610	T-Metals, ABA
WR-2A	WR	3,000	West of fork in road	None	6.47 (S)	0.035			
WR-2B	WR		West of fork in road	None	6.92 (S)	0.02			
WR-3	WR	950	East of fork in road	None	6.79 (S)	0.06			
WR-4	WR	180	Furthest north	None	6.96 (S)	0.03			
SS-1	BKG/MD	N/A	Background soil across from Adit #4	N/A	4.91 (S)	0.03	01-005-SS-1	06/14/93 1630	T-Metals

\*Direct reading(Radiacal Meter); S-Disturbed Sample(Onion Meter)

Comments or deviations from SOPs: 01-005-TP-1 is composite of TP-1A-A through -1A-C and TP-1B-A through -1B-E. 01-112-WR-1 is composite of WR-1, WR-2A and -2B, WR-3, and WR-4.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Filled shafts: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Seeps/Springs: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Groundwater wells within 4 miles?: Yes X, No\_\_\_;  
Number of well logs: 25

Distance to nearest well used for drinking? 2 miles

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite\_\_\_, Probable\_\_\_, Possible\_\_\_, Unlikely X.

Uncontained sources containing elevated arsenic levels, but with no surface expression of groundwater.

Other observations/notes: N/A



## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes     , No X, Name(s):                     

Dry streambeds: Yes X, No     , Name(s): Ermont Gulch

Other surface water: Yes     , No X, Name(s)/Description:                     

Waste materials within any floodplain: Yes X, No      Source ID(s):       
Tailings from mill are in Ermont Gulch.

Approximate Flood frequency? X 1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)? N/A (Dry)  
High Flow:                     , Average Flow:                     

Distance between waste source(s) and nearest surface water body (ft)? 0  
0 feet; tailings are in Ermont Gulch. There is 1,000 feet between WR-3 from Ermont No. 19 to Ermont Gulch.

Surface water draining onto or through waste sources: Yes X, No     ,  
Describe: Ermont Gulch; however, it was dry at the time of this investigation.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Fishery, wetland, irrigation

Observed erosional/sedimentation/stream turbidity problems? Yes     ,  
No X, Distance downstream (ft)?                      Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):       
Dry

**SAMPLERS:** Babits, Belanger

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? 20 acres

Wetlands present: Yes     , No X, Describe:                     

Carbonate rocks/soils: Yes     , No X, Describe: Carbonate rocks are present on the dumps at Ermont No. 19. Dolomite is described in literature as host rock for all three sites.

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10     ; 10-30     ; 30-100 X; 100-300     ; 300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ; Comments                     

Nearest residence (ft or miles)? 2 miles

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



**ACID DRAINAGE/AIR PATHWAY INVENTORY FORM**

**SAMPLERS:** Babits, Belanger, Pierson, Lasher

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (CLASS)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/FIELD/NO MODERATE/LOW/HIGH)
TP-1	None	Dry	333,000	333,000	Yes	Moderate
WR-1	SO3	Partial	180	180	Yes	Low
WR-2	SO3	Partial	16,200	16,200	Yes	Low
WR-3	SO3	Partial	5,130	5,130	Yes	Low
WR-4	SO3	Partial	900	900	Yes	Low
Pit at No. 2	SO3	Moist	2 acres	2 acres	Yes	Low/Moderate

Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X, Describe: \_\_\_\_\_

Population within 1 mile: 1-10 X; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_; 300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_; Comments \_\_\_\_\_

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: Litter; gun shells \_\_\_\_\_

Accessibility - Fences, warning signs, closed roads? Unrestricted \_\_\_\_\_

Sensitive environments on-site or adjacent to site:

State or National Parks - Yes\_\_\_\_, No X, Comment \_\_\_\_\_  
Wilderness Area - Yes\_\_\_\_, No X, Comment \_\_\_\_\_  
T&E Species Habitat - Yes\_\_\_\_, No X, Comment \_\_\_\_\_  
Bat Habitat - Yes\_\_\_\_, No X, Comment \_\_\_\_\_

Primary Drainage\_\_\_\_; Secondary Drainage\_\_\_\_; No Information X :

Riparian Habitat Quality - High\_\_\_\_, Medium\_\_\_\_, Low\_\_\_\_  
Wetlands Frontage - High\_\_\_\_, Medium\_\_\_\_, Low\_\_\_\_  
Fisheries Habitat and Species Classification - \_\_\_\_\_  
Sport Fishery Classification - \_\_\_\_\_

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No\_\_\_\_, Number 6, types and locations: Pit at Ermont No. 2; two shafts at Ermont No. 19; one shaft at pit; one adit at mill; and, one adit at pit \_\_\_\_\_

Hazardous structures: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes X, No\_\_\_\_, Number\_\_\_\_, types and locations: Pit at Ermont No. 2 \_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain: \_\_\_\_\_



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LABORATORY ANALYTICAL DATA

ERMONT MILL  
PA NO. 01-005



Ermont Mill and Mines PA# 01-005  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BABITS  
INVESTIGATION DATE: 06/14/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
01-005-TP-1	3510	796	1.3	11.5	11.8	22.4	36500	1.36 J	852	14	61	54 J	334	13.5
01-112-WR-1	431	192	0.4 U	9.3	5.1	17.6	20300	1.06 J	629	6	16	10 J	43	NR
BACKGROUND	76	134	0.5 U	3	10	14.1	12100	0.024 J	482	10	23	7 J	59	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL SULFUR ACID BASE 1/1000	NEUTRAL. POTENT. 1/1000	SULFUR ACID BASE POTENT. 1/1000	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC SULFUR ACID BASE 1/1000	SULFUR ACID BASE POTENT. 1/1000
01-005-TP-1	0.14	4.37	84.2	79.8	0.02	<0.01	0	84.2
01-112-WR-1	<0.01	0	398	398	<0.01	0.01	0.31	398

LEGEND

TP1 - Composite of subsamples TP1A-A, -B, -C, and 1B-A, -B, -C, -D, -E.  
WR1 - Composite of subsamples WR1, 2A, 2B, 3, and 5.  
BACKGROUND - Across drainage from adit #4.  
From the Ermont Mill (01-005-SS-1).





XRF ANALYSIS RESULTS

ERMONT MILL  
PA NO. 01-005



XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-005-SE-2		10945.2	23289.9	1116.32			18542			75.8705 *	1894.75	120.816
01-005-SS-1		13646.6	7715.28	1789.73		444.875 *	15257.2			96.7771 *	62.7142 *	164.811
01-005-TP1A-A		11130.8	49904.4	1236.13			20291.4			170.781 *	2071.54	161.206
01-005-TP1A-B		28036.3	19611.9	2127.2		1036.44 *	33639.4			417.518	3746.06	181.88
01-005-TP1A-C		22839.8	8432.97	2042.48		552.855 *	36907.5			286.752	2783.94	126.951
01-005-TP1B-A		24425.1	16279	2345.87		832.981 *	36903.7			133.779 *	4199.16	178.919
01-005-TP1B-B		22028.7	15840.4	1910.91		589.451 *	34744.5			140.965 *	3921.2	129.21
01-005-TP1B-C		17427.3	20965	1666.99		501.389 *	26753.1			171.068 *	3407.63	131.688
01-005-TP1B-D		19645.4	16187.8	1538.87		976.162 *	27981.3			205.802	2996.82	83.131
01-005-TP1B-E		20892.7	12280.7	1795.05		642.073 *	28088.2			271.237	3023.31	112.37
01-005-TP-1-COMP		30424.2	14490.6	2302.11		747.597 *	35053.4			470.967	3658.57	202.015
01-112-SS-1		13646.6	7715.28	1789.73		444.875 *	15257.2			96.7771 *	62.7142 *	164.811
01-112-WR2-A		439.678 *	119585	2621.23 *			9527.88			68.9282 *	115.539 *	65.6757
01-112-WR2-B			149045	106.943 *			4355.37			96.7021 *	921.357	172.544
01-112-WR-1		21240.9	35430.3	1246.05		2239.54	32673.5			86.9887 *	1228.07	36.5477
01-112-WR-1-COMP		8640.68	90872.3	1190.59		748.961 *	25541.3			78.7563 *	370.907	143.057
01-112-WR-3		6897.83	39366.3	2030.09			32698.6			92.9486 *	231.982	231.982
01-112-WR-5		31408.8	41660.3	1963.93		773.533 *	40636.1			95.8068 *	238.984	81.7003
Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th		
01-005-SE-2	96.8545			50.4329		833.737	698.442			8.22631 *		
01-005-SS-1	193.72			61.1396			224.189		12.7091 *	11.7846 *		
01-005-TP1A-A	135.922			69.5039		666.117	832.085			7.21276 *		
01-005-TP1A-B	173.538		69.7232 *	143.123		265.712	762.408	74.9959 *		10.3951 *		
01-005-TP1A-C	177.412		45.9199 *	127.391		285.127	1379.02	121.973 *		11.1165 *		
01-005-TP1B-A	209.926			139.12		128.645	769.797			14.9781 *		
01-005-TP1B-B	190.691			122.372		161.201	683.447			7.92011 *		
01-005-TP1B-C	193.832			101.92		420.466	526.755		12.4839 *	11.1091 *		
01-005-TP1B-D	158.538			106.141		301.893	846.714	62.3168 *		7.59544 *		
01-005-TP1B-E	187.417			54.2166 *		458.608	1135.14	68.4418 *		13.5612 *		
01-005-TP-1-COMP	185.297			77.8803 *	109.961 *	593.028	975.975			11.3423 *		
01-112-SS-1	193.72			61.1396			224.189		12.7091 *	11.7846 *		
01-112-WR2-A	34.8416			22.7935 *		172.429	118.873					
01-112-WR2-B		4.58509 *				87.7311 *	9.52103 *					
01-112-WR-1	203.611			142.777						10.163 *		
01-112-WR-1-COMP	139.902			60.54		55.817 *	441.878					
01-112-WR-3	171.365			51.2463 *			611.516					
01-112-WR-5	204.887			155.594			421.641					

\* - Estimated Quantity



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

ERMONT MILLSITE  
PA NO. 01-005





# AIMSS SCORESHEET

SITE NAME:

ERMONT MILL

PA NUMBER:

01-005

LINE NO.				
		<b>GROUNDWATER PATHWAY</b>		
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD	CONTAINMENT		20
3B	OF RELEASE	GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	352.803
6		WELLS - 1 MI. x 2.5		0.0
7	GW - TARGETS	WELLS - 1 TO 4 MI		25
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	25.0
10		<b>GROUNDWATER SCORE</b>	LINES 4 x 5 x 9	1764015
		<b>SURFACE WATER PATHWAY</b>		
11		OBSERVED RELEASE		0
12	SW - LIKELIHOOD	EXCEEDENCES		0
13A	OF RELEASE	CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	400
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	356.289
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		10
19	SW - TARGETS	FISHERY		0
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	17
24		<b>SURFACE WATER SCORE</b>	LINES 14 x 15 x 23	2422765
		<b>AIR PATHWAY</b>		
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD	CONTAINMENT		15
26B	OF RELEASE	DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	75
27		LIKELIHOOD SCORE	LINES 25 + 26C	75
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	3.563
29		POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31	AIR - TARGETS	WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	30
35		<b>AIR PATHWAY SCORE</b>	LINES 27 x 28 x 34	8017
		<b>DIRECT CONTACT PATHWAY</b>		
36		OBSERVED EXPOSURE		50
37A	LIKELIHOOD OF	ACCESSIBILITY		20
37B	EXPOSURE	DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	100
38		LIKELIHOOD SCORE	LINES 36 + 37C	150
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	3.528
40	DIRECT CONTACT	POPULATION - 1 MILE		1
41	TARGETS	NEAREST RESIDENCE		0
42		RECREATIONAL USE		5
43		TARGETS SCORE	SUM LINES 40 - 42	6
44		<b>DIRECT CONTACT SCORE</b>	LINES 38 x 39 x 43	3175
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			
	(LINES 10 + 24 + 35 + 44) / 100,000			41.98

LINE NO.			SITE NAME:	ERMONT MILL
			PA NUMBER:	01-005
	<b>SITE SAFETY</b>			
1	THREAT	ACCESSIBILITY		20
2		OPEN SHAFTS	100 EA.	200
3		OPEN ADITS	50 EA.	100
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	75
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	375
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		5
12		TARGETS SCORE	SUM LINES 9 - 11	6
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>45.00</b>

**SUMMARY OF HISTORICAL ANALYTICAL DATA  
FROM OTHER SOURCES**

TABLE 3-1  
SUMMARY OF ENVIRONMENTAL MONITORING RESULTS

ERMONT MILL-MILL TAILING SITE, ARGENTA, BEAVERHEAD COUNTY, MONTANA.  
BLM SITE CODE: MT 01411A0003  
AEPDO SITE NO. 11, GROUP D  
DATE OF MONITORING: April 23, 1986

MONITORING STATION	MILITARY TIME	LOCATION OF READINGS	hnu PHOTO-IONIZER (ppm Benzene)	METHANE DETECTOR (ppm)	RADIOMETER (nR/hr)	OXYGEN* (%)	EXPLOSION LEVEL (%)	WIND SPEED (mph) AND DIRECTION
01	15:34	The access road leading to the site, about 200 feet away from the waste pile. (Background)	0.0	ND	0.01	18.0	0.01	6-8 (from West)
02	15:38	The southwestern corner of the waste pile. Yellowish brown fine sandy material with no vegetative growth.	0.0	ND	0.01	18.0	0.01	6-8 (from West)
03	15:40	The southern edge of the waste pile, near the eroded earth dam.	0.0	ND	0.01	18.0	0.01	6-8 (from West)
04	15:42	The southeastern corner of the waste pile; no vegetation found in this area.	0.0	ND	0.01	18.0	0.01	6-8 (from West)
05	15:45	Eastern edge of the waste pile. No vegetation is found on the pile. Vegetation is healthy 30 feet east of the waste pile.	0.0	ND	0.01	18.0	0.01	6-8 (from West)
06	15:47	Northern end of the waste pile, next to the water ponds (P-01).	0.0	ND	0.01	18.0	0.01	6-8 (from West)
07	15:49	Northern corner of the waste pile, about 50 feet from the pond (P-01).	0.0	ND	0.01	18.0	0.01	6-8 (from West)
08	15:52	Northern edge of the waste pile.	0.0	ND	0.01	18.0	0.01	6-8 (from West)
09	15:54	Middle of the waste pile.	0.0	ND	0.01	18.0	0.01	6-8 (from West)
10	16:10	Ponds P-02 and P-03.	...	...	...	...	...	...

\* Low oxygen concentration may be due to high altitude at the project site.  
ND = Not detected

**TABLE 4-1**  
**CONCENTRATIONS OF HSL METALS AND OTHER PARAMETERS IN WASTE**  
**AND SURFACE WATER SAMPLES**

ERMONT MILL-MILL TAILING SITE, ARGENTA, BEAVERHEAD COUNTY, MONTANA.  
 BLM SITE CODE: MT 1411A0003  
 AEPCC SITE 11, GROUP D

WASTE				SURFACE WATER		NATIONAL DRINKING WATER STANDARD #	
PARAMETER	UNIT	STATION	DETECTION	RCRA STANDARD***	STATION	DETECTION	
		WS-A*	LIMIT**		SW-A	LIMIT**	
Silver (Ag)	ug/L	< 10	5,000	5,000	ug/L	<10	50
Arsenic (As)	ug/L	240	5,000	5,000	ug/L	820	50
Boron (B)	ug/L	---	---	---	ug/L	37	---
Barium (Ba)	ug/L	985	100,000	100,000	ug/L	---	---
Beryllium (Be)	ug/L	---	---	---	ug/L	<5	5
Cadmium (Cd)	ug/L	< 5	1,000	1,000	ug/L	<5	10
Cobalt (Co)	ug/L	---	---	---	ug/L	<50	50
Chromium (Cr)	ug/L	< 10	5,000	5,000	ug/L	<10	10
Copper (Cu)	ug/L	---	---	---	ug/L	<25	25
Mercury (Hg)	ug/L	< 0.2	200	200	ug/L	0.32	0.2
Manganese (Mn)	ug/L	---	---	---	ug/L	27	15
Nickel (Ni)	ug/L	---	---	---	ug/L	<40	40
Lead (Pb)	ug/L	7	5,000	5,000	ug/L	<5	5
Selenium (Se)	ug/L	< 5	1,000	1,000	ug/L	<5	5
Thallium (Te)	ug/L	---	---	---	ug/L	<10	10
Vanadium (V)	ug/L	---	---	---	ug/L	<50	50
Tungsten (W)	ug/L	8,790	---	---	ug/L	---	---
Gold (Au)	ug/L	83	---	---	ug/L	<25	---
Iron (Fe)	ug/L	---	---	---	ug/L	843	100
Zinc (Zn)	ug/L	---	---	---	ug/L	<20	20
Percent Solids	(%)	89.03	---	---	---	---	---
Ignitability: Flash Point	deg. C	>200	---	---	---	---	---
Corrosivity: pH	Std. Unit	8.0##	---	<2 or >12	---	---	6.5-8.5
Reactivity:							
Total Sulfide	mg/Kg	1.65	---	---	---	---	---
Total Cyanide	mg/Kg	15.8	---	---	---	---	---
Cyanide		---	---	---	ug/L	<10	---

WS-A = Waste Sample

SW-A = Surface Water Sample

\* Extraction Procedure (EP) toxicity test results

\*\* EPA detection limits based on zero dilution

\*\*\* Resource Conservation and Recovery Act

# National Interim Primary and Secondary Drinking Water Standards

## pH greater than 2 and less than 12 indicates noncorrosive characteristics.

ND = Not detected or below detection limit

--- Not applicable or analysis not requested.

**TABLE 4-2**  
**CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS IN WASTE SAMPLES**

ERMONT MILL-MILL TAILING SITE, ARGENTA, BEAVERHEAD COUNTY, MONTANA.  
BLM SITE CODE: MT 01411A0003  
AEPCO SITE 11; GROUP D

PARAMETER	WASTE		
	UNIT	STATION WS-A	DETECTION LIMIT
Acetone	ug/Kg	220	10
Benzene	ug/Kg	ND	10
Bromoform	ug/Kg	ND	10
2-Butanone	ug/Kg	ND	10
Carbon Tetrachloride	ug/Kg	ND	10
Carbon Disulfide	ug/Kg	ND	10
Chlorobenzene	ug/Kg	ND	10
Chlorodibromomethane	ug/Kg	ND	10
Chloroethane	ug/Kg	ND	10
2-Chloroethylvinylether	ug/Kg	ND	10
Chloroform	ug/Kg	ND	10
cis-1,3-Dichloropropane	ug/Kg	ND	10
Dichlorobromomethane	ug/Kg	ND	10
1,1-Dichloroethane	ug/Kg	ND	10
1,2-Dichloroethane	ug/Kg	ND	10
1,1-Dichloroethylene	ug/Kg	ND	10
1,2-Dichloropropane	ug/Kg	ND	10
Trans-1,3-Dichloropropene	ug/Kg	ND	10
Ethylbenzene	ug/Kg	ND	10
2-Hexanone	ug/Kg	ND	10
Methyl bromide	ug/Kg	ND	10
Methyl chloride	ug/Kg	ND	10
Methylene Chloride	ug/Kg	ND	10
4-Methy-2-Pentanone	ug/Kg	ND	10
Styrene	ug/Kg	ND	10
1,1,2,2-Tetrachloroethane	ug/Kg	ND	10
Tetrachloroethylene	ug/Kg	ND	10
Toluene	ug/Kg	ND	10
1,2-trans-Dichloroethylene	ug/Kg	ND	10
1,1,1-Trichloroethane	ug/Kg	ND	10
1,1,2-Trichloroethane	ug/Kg	ND	10
Trichloroethylene	ug/Kg	ND	10
Trichlorofluoromethane	ug/Kg	ND	10
Vinyl Chloride	ug/Kg	ND	10
Vinyl Acetate	ug/Kg	ND	10
Total Xylenes	ug/Kg	ND	10
DILUTION RATIO	---	1X	1X

WS-A = Waste Sample

ND = Not detected or below detection limit

--- Not applicable



**TABLE 4-3**  
**CONCENTRATIONS OF ACID BASE EXTRACTABLE**  
**ORGANIC COMPOUNDS IN WASTE SAMPLES**

ERMONT MILL-MILL TAILING SITE, ARGENTA, BEAVERHEAD COUNTY, MONTANA.  
 BLM SITE CODE: MT 01411A0003  
 AEPCO SITE 11; GROUP D

PARAMETER	UNIT	WASTE	
		STATION WS-A	DETECTION LIMIT
Benzoic Acid	ug/Kg	ND	5,000
2-Chlorophenol	ug/Kg	ND	1,000
2,4-Dichlorophenol	ug/Kg	ND	1,000
2,4-Dimethylphenol	ug/Kg	ND	1,000
4,6-Dinitro-o-cresol	ug/Kg	ND	5,000
2,4-Dinitrophenol	ug/Kg	ND	5,000
2-Methylphenol	ug/Kg	ND	1,000
4-Methylphenol	ug/Kg	ND	1,000
2-Nitrophenol	ug/Kg	ND	1,000
4-Nitrophenol	ug/Kg	ND	5,000
p-Chloro-m-cresol	ug/Kg	ND	1,000
Pentachlorophenol	ug/Kg	ND	5,000
Phenol	ug/Kg	ND	1,000
2,4,5-Trichlorophenol	ug/Kg	ND	5,000
2,4,6-Trichlorophenol	ug/Kg	ND	1,000
DILUTION RATIO	---	100X	100X

WS-A = Waste Sample

--- = Not applicable

ND = Not detected or below detection limit

\* = Found below method detection limit

**TABLE 4-4**  
**CONCENTRATIONS OF BASE/NEUTRAL EXTRACTABLE**  
**ORGANIC COMPOUNDS IN WASTE SAMPLES**

ERMONT MILL-MILL TAILING SITE, GLEN, BEAVERHEAD COUNTY, MONTANA.  
3LM SITE CODE: MT 1411A0003  
AEPCC SITE 11; GROUP D

PARAMETER	UNIT	WASTE	
		STATION WS-A	DETECTION LIMIT
Acenaphthene	ug/Kg	ND	1,000
Acenaphthylene	ug/Kg	ND	1,000
Aniline	ug/Kg	ND	1,000
Anthracene	ug/Kg	ND	1,000
Benzo (a) anthracene	ug/Kg	ND	1,000
Benzo (a) pyrene	ug/Kg	ND	1,000
Benzo (b) Fluoranthene	ug/Kg	ND	1,000
Benzo (ghi) perylene	ug/Kg	ND	1,000
Benzo (k) fluoranthene	ug/Kg	ND	1,000
Benztidine	ug/Kg	ND	1,000
Benzyl alcohol	ug/Kg	ND	1,000
3,4-Benzofluoranthene	ug/Kg	ND	1,000
Bis (2-chloroethyl) ether	ug/Kg	ND	1,000
Bis (2-chloroisopropyl) ether	ug/Kg	ND	1,000
Bis (2-chloroethoxy) methane	ug/Kg	ND	1,000
Bis (2-chloroisopropyl) ether	ug/Kg	ND	1,000
Bis (2-ethylhexyl) phthalate	ug/Kg	ND	1,000
4-Bromophenyl phenyl ether	ug/Kg	ND	1,000
Butyl benzyl phthalate	ug/Kg	ND	1,000
4-Chloroaniline	ug/Kg	ND	1,000
2-Chloronaphthalene	ug/Kg	ND	1,000
4-Chlorophenyl phenyl ether	ug/Kg	ND	1,000
Chrysene	ug/Kg	ND	1,000
Dibenzo (a,h) anthracene	ug/Kg	ND	1,000
Dibenzofuran	ug/Kg	ND	1,000
1,2-Dichlorobenzene	ug/Kg	ND	1,000
1,3-Dichlorobenzene	ug/Kg	ND	1,000
1,4-Dichlorobenzene	ug/Kg	ND	1,000
3,3-Dichlorobenzidine	ug/Kg	ND	1,000
2,4-Dinitrotoluene	ug/Kg	ND	1,000
2,6-Dinitrotoluene	ug/Kg	ND	1,000
1,2-Diphenylhydrazine (as azobenzene)	ug/Kg	ND	1,000
Di-n-butyl phthalate	ug/Kg	ND	1,000
Di-n-octyl phthalate	ug/Kg	ND	1,000
Diethyl phthalate	ug/Kg	ND	1,000
Dimethyl phthalate	ug/Kg	ND	1,000
Fluoranthene	ug/Kg	ND	1,000
Fluorene	ug/Kg	ND	1,000
Hexachlorobenzene	ug/Kg	ND	1,000
Hexachloroethane	ug/Kg	ND	1,000
Hexachlorobutadiene	ug/Kg	ND	1,000
Hexachlorocyclopentadiene	ug/Kg	ND	1,000
Indeno (1,2,3-cd) pyrene	ug/Kg	ND	1,000
Isophorone	ug/Kg	ND	1,000
2-Methylnaphthalene	ug/Kg	ND	1,000
Naphthalene	ug/Kg	ND	1,000
2-Nitroaniline	ug/Kg	ND	1,000
3-Nitroaniline	ug/Kg	ND	1,000
4-Nitroaniline	ug/Kg	ND	1,000
Nitrobenzene	ug/Kg	ND	1,000
N-Nitrosodimethylamine	ug/Kg	ND	1,000
N-Nitrosodiphenylamine	ug/Kg	ND	1,000
N-Nitrosodi-N-Propylamine	ug/Kg	ND	1,000
Phenanthrene	ug/Kg	ND	1,000
Pyrene	ug/Kg	ND	1,000
1,2,4-Trichlorobenzene	ug/Kg	ND	1,000
DILUTION RATIO	---	1X	1X

WS-A = Waste Sample

ND = Not detected or below detection limit

--- = Not applicable

\* = Found below method detection limit

**TABLE 4-5**  
**CONCENTRATIONS OF PESTICIDE AND PCBs**  
**IN WASTE SAMPLES**

ERMONT MILL-MILL TAILING SITE, ARGENTA, BEAVERHEAD COUNTY, MONTANA.  
BLM SITE CODE: MT 1411A0003  
AEPCO SITE 11; GROUP D

PARAMETER	UNIT	WASTE	
		STATION WS-A	DETECTION LIMIT
Aldrin	ug/Kg	ND	1,000
Alpha-BHC	ug/Kg	ND	1,000
Beta-BHC	ug/Kg	ND	1,000
Gamma-BHC	ug/Kg	ND	1,000
Delta-BHC	ug/Kg	ND	1,000
Chlorodane	ug/Kg	ND	1,000
4,4'-DDT	ug/Kg	ND	1,000
4,4'-DDE	ug/Kg	ND	1,000
4,4'-DDD	ug/Kg	ND	1,000
Dieldrin	ug/Kg	ND	1,000
Alpha-Endosulfan	ug/Kg	ND	1,000
Beta-Endosulfan	ug/Kg	ND	1,000
Endosulfan sulfate	ug/Kg	ND	1,000
Endrin	ug/Kg	ND	1,000
Endrin aldehyde	ug/Kg	ND	1,000
Heptachlor	ug/Kg	ND	1,000
Heptachlor epoxide	ug/Kg	ND	1,000
PCB-1242 (Aroclor 1242)	ug/Kg	ND	1,000
PCB-1254 (Aroclor 1254)	ug/Kg	ND	1,000
PCB-1221 (Aroclor 1221)	ug/Kg	ND	1,000
PCB-1232 (Aroclor 1232)	ug/Kg	ND	1,000
PCB-1248 (Aroclor 1248)	ug/Kg	ND	1,000
PCB-1260 (Aroclor 1260)	ug/Kg	ND	1,000
PCB-1016 (Aroclor 1016)	ug/Kg	ND	1,000
Toxaphene	ug/Kg	ND	10,000
DILUTION RATIO	---	100X	10,000X

WS-A = Waste Sample

ND = Not detected or below detection limit

--- Not applicable

CHEMISTRY LABORATORY BUREAU  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

REPORT TO: Solid and Hazardous Waste Bureau

ATTENTION: Carol Fox

SUBJECT: Analytical results for Ermont Mill

<u>Laboratory #:</u>	<u>Sample # or ID:</u>	<u>Sample Description:</u>
SW 4069	ER - 01	tailings, composite surface soil

SAMPLE HANDLING INFORMATION:

SAMPLES SUBMITTED BY:	Carol Fox
DATE SAMPLES COLLECTED:	9/22/89
DATE RECEIVED IN LABORATORY:	9/22/89
DATE REPORTED BY LABORATORY:	11/8/89
RESPONSIBILITY CODE:	# 2231

<u>LABORATORY #:</u>	<u>SW 4069</u>	<u>SW 4069 dup</u>	<u>NBS 1645</u>
As	2360.	2700.	89% recovery
Ba	845.	852.	--
Cd	<.81	<.81	--
Cr	<3.2	<3.2	89%
Fe	30870.	30900.	88%
Hg	1.26	1.24	.62 (.60 - 1.6 OK)
Mn	528.	522.	96%
Be	<.16	<.16	--
Ni	17.9	17.9	120%
Cu	8.1	8.1	97%
Zn	114.	87.	91%
Pb	15.0	13.0	104%

NOTE: RESULTS IN MICROGRAMS PER GRAM

METHOD:

Microwave digestion of dried sample  
EPA 200.7 Inductively Coupled Plasma for metals analysis

REPORT SUBMITTED BY

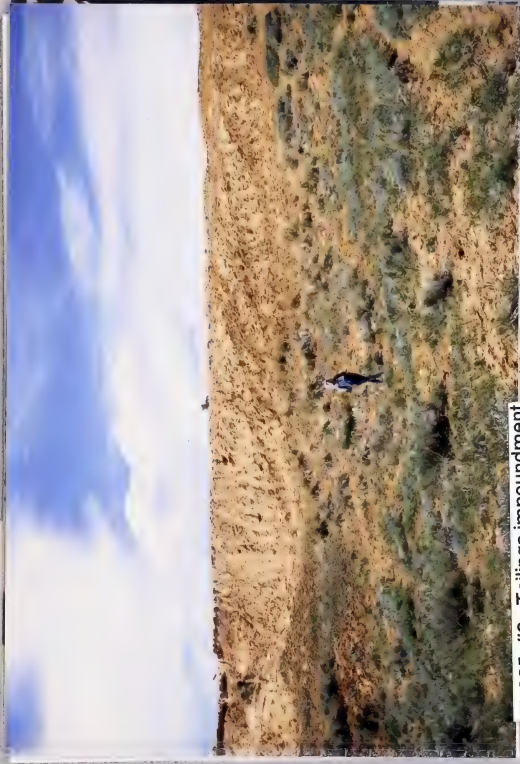
*Judy Halm*

Judy Halm, Chemist  
Chemistry Laboratory Bureau





01-005, #5: Tailings impoundment



01-005, #6: Tailings impoundment



01-005, #7: Background soil location



01-005, #9: Up drainage to south



01-005, #12: Adit at metal building, northwest of tailings





01-112, #2: Shaft #1



01-112, #32: Shaft #3



01-112, #1: WR-5



01-112, #3: WR-1



01-112, #33: WR-3



01-112, #34: WR-2 and adit



01-112, #35: WR-2



01-112, #36: Shaft #4



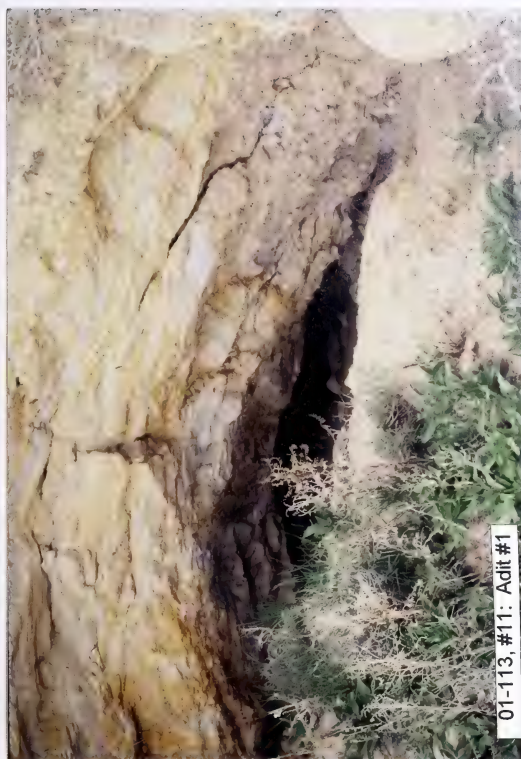


01-112, #37: Shaft #5

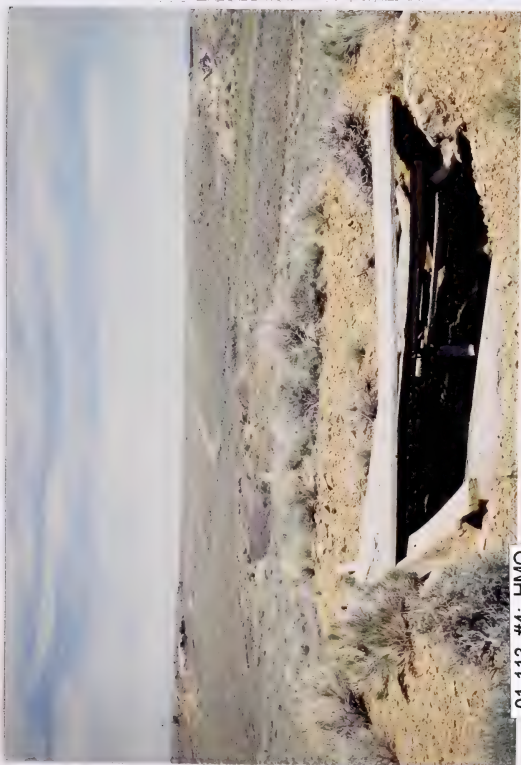




01-113, #8: HMO



01-113, #11: Adit #1



01-113, #4: HMO



01-113, #10: Shaft #1









MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: SILVER KING PA#: 01-094

Date: August 26, 1993 Time: 1100-1230

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Tuesday, Pioneer

Visitors: None

Weather/Seasonality Observations: Snow shower; approx. 33°F;  
slight breeze; cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): No photos taken.  
Video Tape No. 4

General Comments/Observations (not covered specifically in attached Inventory Forms): Several open shafts on ridge between the Lion Mountain Road and  
the Trapper Creek drainage with no signs or fences.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Flatten  
slope; fill subsidence; revegetate.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): SILVER KING PA#: 01-094

Legal Description: T 3S ; R 11W ; Sec. 11 , NE 1/4 SW 1/4 1/4

County: BEAVERHEAD Mining District: HECLA

Latitude: N 45° 35' 08" Longitude: W 112° 55' 42"

Primary Drainage Basin and Code: Big Hole River/10020004

Secondary Drainage Basin: Trapper Creek

USGS Quadrangle map name(s): Mount Tahepia

Mine Type/Commodities: Hardrock/Lead, Zinc, Silver

Activity Status: Active    , Inactive/Exploration    , Abandoned X .

Ownership status: Known YX N ; private/public? Private

Owner, Agent, or Contact (Include address and phone when available): Robert Dundy,  
University of Mississippi, Jackson, MI.

Relationship to other mines/sites in the area/district: Many  
prospects in the area.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 8280' , Slope 25°-30° ,  
Aspect East

Land use: Mining    , Recreational X , Residential    , Urban    ,  
Agricultural    , Other (Specify)   

Area of disturbed/unvegetated lands? 0.05 acres.  
Dimensions: 130 feet x 50 feet

Predominant vegetation types: Lodgepole pine, Engleman spruce,  
Subalpine fir, Whitebark pine, juniper, grouse whortleberry

Access: roads - good    , poor    , 4wd    , trail X .  
Other logistical considerations (proximity to other sites). Trail  
from where 4wd road crosses Sappington Creek headed southeast past  
several open shafts (HMOs with no fencing).

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Mine is located in the Trapper Creek  
Basin. The Hecla Basin is underlain by an igneous cupola. Ore was  
deposited in overlying sediments by ascending metalliferous  
solutions emanating from the magma.

Mining/milling history, ore type/tenor, host rock, gangue: Only  
recorded production was in 1913; ore was taken from a sulfide vein  
near the intrusive contact in Pilgram Limestone.

Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 2, Comment Caved  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

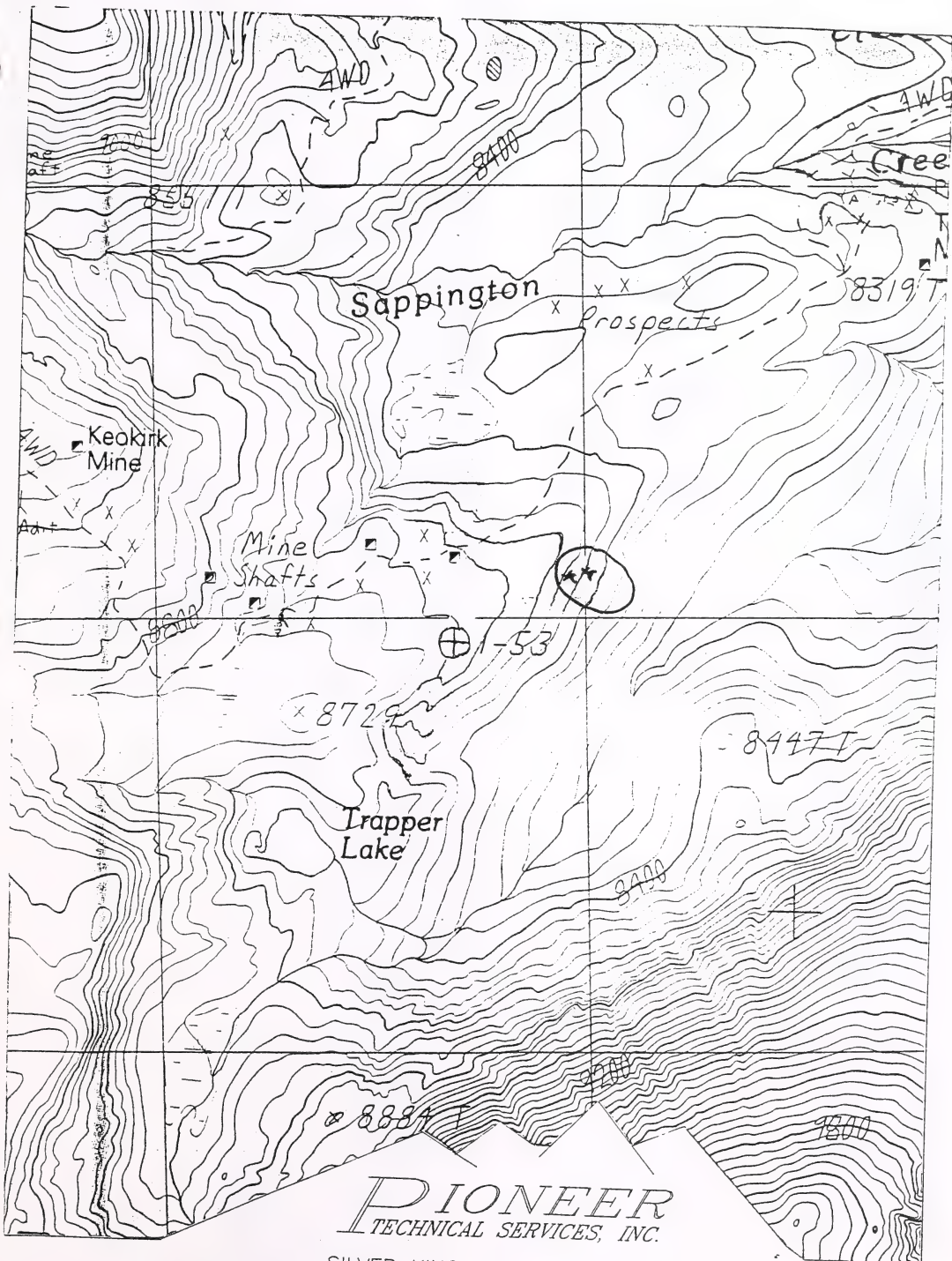
Mill Operation? Yes     , No X. If yes answer the next three  
questions:

Period(s) of Operation: N/A

Origin of Ore Milled - Custom Mill      Dedicated Mill     ; Number and  
names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
N/A





**PIONEER**  
TECHNICAL SERVICES, INC.

SILVER KING, P.A. NO. 01-094

T03S, R11W, SECTION 11

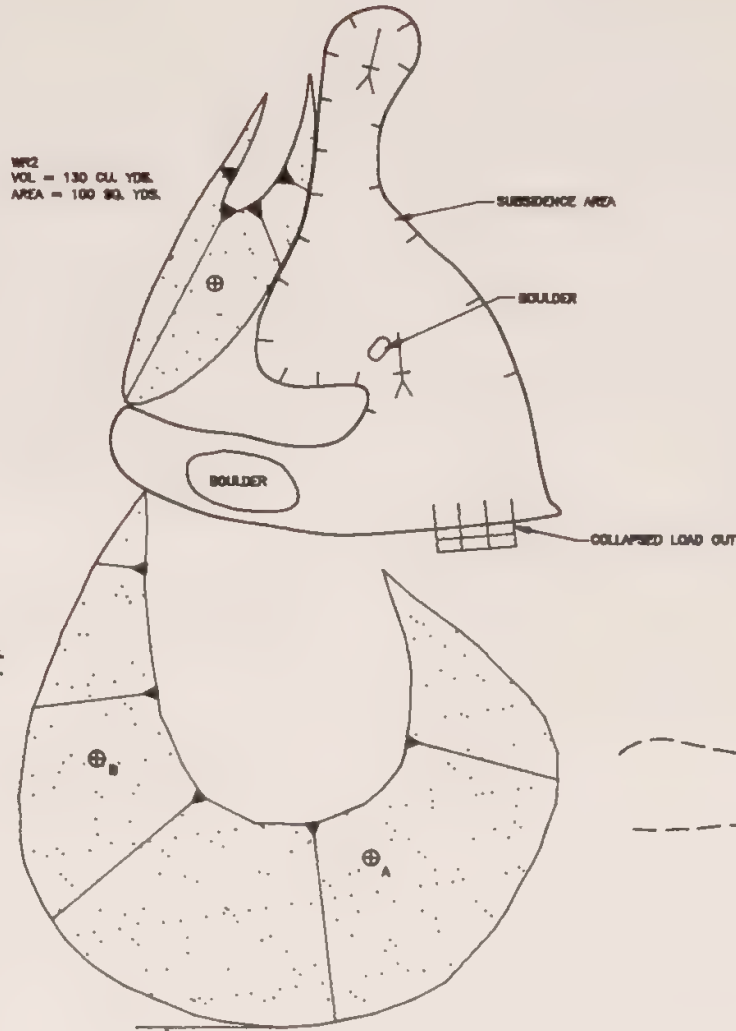
SCALE: 1" = 1000'





NOT TO SCALE

WP2  
VOL = 130 CU. YDS.  
AREA = 100 SQ. YDS.



WP1  
VOL = 1000 CU. YDS.  
AREA = 400 SQ. YDS.

1/4 MILE

TRAPPER LAKE  
1/4 MILE

TRAPPER CREEK

EXISTING	DESCRIPTION
---	CULVERT
*	LIGHT (LIGHT POLE)
□	UTILITY POLE
●	DECIDUOUS TREE
⊙	CONIFEROUS TREE
— —	WOOD FENCE
— — —	WIRE FENCE
▨	BUILDING
○	BARRIER POST
∧	GATE
-.-	EDGE OF ASPHALT
-.-.-	EDGE OF GRAVEL
▲	SLOPE DIRECTION
⬆	TAILINGS POND

#### LEGEND

EXISTING	DESCRIPTION
— —	OPEN ADIT
— — —	COLLAPSED ADIT
⊠	OPEN SHAFT
⊞	COLLAPSED SHAFT
⬆	EXCAVATION
⬆	WASTE ROCK DUMP
⬆	COLLAPSED TIMBERS
— —	RAILS
⊙	SOIL SAMPLE
⊙	XRF SAMPLE
⊙	WATER SAMPLE
⊙	GROUND AND SURFACE
⊙	DRAINAGE
⊙	WATER WELL
⊙	PONDED WATER
⊙	VEGETATED WET LANDS

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

SILVER KING PA# 01-094  
HECLA DISTRICT BEAVERHEAD COUNTY

SHEET NO.

PIONEER  
ENGINEERING CONSULTANTS

TDSH

DRAWN: CAN DATE 11/30/93  
DESIGNED: TPR JOB NO. 93-17  
APPROVED: KUB F.B. NO.

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): \_\_\_\_\_  
N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): \_\_\_\_\_  
N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): \_\_\_\_\_  
N/A

Comments on potential for mitigation: \_\_\_\_\_  
N/A





SAMPLERS: Bullock

[illegible]

D-Direct reading (Kelvin Meter); 3-Saturated Paste (Circus Meter)

**Comments or deviations from SOPs:** 01-094-WR-1 is composite of WR-1A and -1B, and WR-2.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map.

Flowing adits: Yes ☐, No ☒, Number:  Identification:

Filled shafts: Yes ☐, No ☒, Number:  Identification:

Seeps/Springs: Yes ☐, No ☒, Number:  Identification:

Groundwater wells within 4 miles?: Yes ☐, No ☒;  
Number of well logs:  0

Distance to nearest well used for drinking?  > 4 miles

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite ☐, Probable ☐, Possible ☐, Unlikely ☒.

Adits are near the top of the hill; little groundwater is likely to be present. Limestone is present to buffer water that may pass through the old workings.

Other observations/notes:  N/A

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes\_\_\_\_, No X, Name(s): The site is approx. 1/4 mile above Trapper Creek.

Dry streambeds: Yes\_\_\_\_, No X, Name(s): \_\_\_\_\_

Other surface water: Yes\_\_\_\_, No X, Name(s)/Description: \_\_\_\_\_

Waste materials within any floodplain: Yes\_\_\_\_, No X Source ID(s): \_\_\_\_\_

Approximate Flood frequency? \_\_\_\_1 yr, \_\_\_\_10 yr, \_\_\_\_100 yr

Estimated seasonal flow of stream(s) (cfs)? N/A

High Flow: \_\_\_\_\_, Average Flow: \_\_\_\_\_

Distance between waste source(s) and nearest surface water body (ft)? 1/4 mile to Trapper Creek

Surface water draining onto or through waste sources: Yes\_\_\_\_, No X, Describe: \_\_\_\_\_

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?) N/A

Observed erosional/sedimentation/stream turbidity problems? Yes\_\_\_\_, No X, Distance downstream (ft)? \_\_\_\_\_ Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): N/A



## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? N/A

Wetlands present: Yes     , No X, Describe:     

Carbonate rocks/soils: Yes X, No     , Describe: Pilgram limestone/dolomite

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10     ; 10-30     ; 30-100     ; 100-300     ; 300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ; Comments None

Nearest residence(ft or miles)? Approx. 6 miles

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



SAMPLERS: Bullock

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe:\_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments None

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe:\_\_\_\_\_  
Campfire rings

Accessibility - Fences, warning signs, closed roads? Difficult trail

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment_____
Wilderness Area -	Yes____, No <u>X</u> , Comment_____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment_____
Bat Habitat -	Yes____, No <u>X</u> , Comment_____

Primary Drainage X; Secondary Drainage\_\_\_\_; No Information\_\_\_\_:

Riparian Habitat Quality - High X, Medium\_\_\_\_, Low\_\_\_\_  
Wetlands Frontage - High X, Medium\_\_\_\_, Low\_\_\_\_  
Fisheries Habitat and Species Classification - 4  
Sport Fishery Classification - 4

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Hazardous structures: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_,  
types and locations:\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes X, No\_\_\_\_,  
Number 2, types and locations: Waste rock dumps are 30° slopes.  
\_\_\_\_\_  
\_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain:\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Bibliography

MBMG, Mines and Mineral Deposits (Except Fuels), Beaverhead County, Montana, Bulletin No. 85, Author Unknown, April 1972.

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Silver King, Prepared by Northern Engineering and Testing, September 22, 1987.

USGS, Mining Districts of the Dillon Quadrangle, Montana, and Adjacent Areas, Bulletin 574, Written by Alexander N. Winchell, 1914.

USGS, Topographic Map, Mount Tahepia, Montana, 7 1/2 minute Quadrangle, 1988.



LABORATORY ANALYTICAL DATA

SILVER KING  
PA NO. 01-094





Silver King PA# 01-094  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 08/26/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
01-094-WR-1	91.9	23 J	918.00 J	2.68	4.57 JX	266	25800	26.6 J	544 J	7.99 JX	32300 JX	339 J	113000 J	NR
BACKGROUND	43	104	2.2	6.5	5.1	382	19200	0.085 J	582	3	56	4 UJ	117	<0.271

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL		SULFUR		SULFATE		PYRITIC		ORGANIC		PYRITIC		SULFUR	
	SULFUR %	ACID BASE % w/1000t	NEUTRAL POTENT. % w/1000t	ACID BASE POTENT. % w/1000t	SULFATE SULFUR %	SULFATE SULFUR %	PYRITIC SULFUR %	PYRITIC SULFUR % w/1000t	ORGANIC SULFUR %	ORGANIC SULFUR % w/1000t	PYRITIC SULFUR % w/1000t	PYRITIC SULFUR % w/1000t	ACID BASE POTENT. % w/1000t	SULFUR ACID BASE POTENT. % w/1000t
01-094-WR-1	0.67	20.9	401	380	<0.01	0.66	0.3	20.6	0.3	0.28	21.9	21.9	381	384
01-094-WR-1DUP	0.67	20.9	406	385	<0.01	0.7	0.28	21.9	0.28	0.28	21.9	21.9	384	384

LEGEND

SE2 -  
WR1 - Composite of subsamples WR1A, 1B, and 2  
BACKGROUND - From the Indian Queen Mine (01-094-SS-1).  
WR1DUP - Duplicate of the 01-094-WR-1 sample.



XRF ANALYSIS RESULTS

SILVER KING  
PA NO. 01-094



Mine Name: Silver King PA# 01-094  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-094-WR1-A		4360.69	95655.4	1066.45		587.406 *	18352.9		183.466 *	10465.7		229.776
01-094-WR1-B		4321.89	87021.3	550.457		816.861 *	47160.2		494.908	38375.1		149.238
01-094-WR-1-COMP		3470.54	90080.4	721.661		51.4648 *	41234.1	354.454 *	420.251	28705.4		193.707
01-094-WR-2		959.968 *	121709	535.072		548.659 *	26616.6		325.622	16133.8		119.461
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-094-WR1-A	101.194			6214.63	53.8662 *	252.34 *	113.539 *	296.31	104.469 *	16.5216 *		
01-094-WR1-B	56.2729			9472.99	52.8577 *	301.658 *	195.955 *	57.9158 *	137.423 *			
01-094-WR-1-COMP	53.2568	66.1389 *		8854.2	39.7123 *	401.637 *	198.255 *	100.378	176.669 *			
01-094-WR-2	20.5633 *			5782.57	25.9992 *	328.374 *	176.518 *		156.242 *		14.7216 *	

\* - Estimated Quantity  
\$ - Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

SILVER KING  
PA NO. 01-094



# AIMSS SCORESHEET

SITE NAME:

SILVER KING

PA NUMBER:

01-094

LINE NO.		GROUNDWATER PATHWAY	
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	20
3B		GW DEPTH	2
3C		POTENTIAL TO RELEASE	40
4		LIKELIHOOD SCORE	40
5	GW - WASTE CHAR.	CALCULATED SCORE	33.688
6		WELLS - 1 MI. x 2.5	0.0
7	GW - TARGETS	WELLS - 1 TO 4 MI	0
8		NEAREST WELL	0
9		TARGETS SCORE	0.0
10		GROUNDWATER SCORE	0
		SURFACE WATER PATHWAY	
11		OBSERVED RELEASE	0
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES	0
13A		CONTAINMENT	20
13B		DISTANCE TO SW	2
13C		POTENTIAL TO RELEASE	40
14		LIKELIHOOD SCORE	40
15	SW - WASTE CHAR.	CALCULATED SCORE	37.150
16		DRINKING WATER POP'N	0
17		IMPACTED DRAINAGE	0
18	SW - TARGETS	WETLANDS	0
19		FISHERY	1
20		RECREATION	0
21		IRRIGATION/STOCK	2
22		T & E SPECIES HABITAT	0
23		TARGETS SCORE	3
24		SURFACE WATER SCORE	4458
		AIR PATHWAY	
25		OBSERVED RELEASE	0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT	10
26B		DISTANCE TO POPULATION	5
26C		POTENTIAL TO RELEASE	50
27		LIKELIHOOD SCORE	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	0.372
29		POPULATION - 4 MILES	0
30		NEAREST RESIDENCE	0
31	AIR - TARGETS	WETLANDS	10
32		PARKS / WILDERNESS	0
33		T & E SPECIES HABITAT	0
34		TARGETS SCORE	10
35		AIR PATHWAY SCORE	186
		DIRECT CONTACT PATHWAY	
36		OBSERVED EXPOSURE	50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY	10
37B		DISTANCE TO POPULATION	5
37C		POTENTIAL EXPOSURE	50
38		LIKELIHOOD SCORE	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	0.337
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE	0
41		NEAREST RESIDENCE	0
42		RECREATIONAL USE	2
43		TARGETS SCORE	2
44		DIRECT CONTACT SCORE	67
45	TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE		0.05
	(LINES 10 + 24 + 35 + 44) / 100,000		

LINE NO.			SITE NAME:	SILVER KING
			PA NUMBER:	01-094
	<b>SITE SAFETY</b>			
1	THREAT	ACCESSIBILITY		10
2	HAZARDS	OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4		UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	0
9	TARGETS	POPULATION - 1 MILE		0
10		NEAREST RESIDENCE		0
11		RECREATIONAL USE		2
12		TARGETS SCORE	SUM LINES 9 - 11	2
13	SITE SAFETY SCORE		(LINES 1 x 8 x 12) / 1,000	0.00

MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: LOWER & UPPER CLEVE PA#: 01-143

Date: September 14, 1993 Time: 1100-1330

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Pierson, TD&H  
\_\_\_\_\_  
\_\_\_\_\_

Visitors: None  
\_\_\_\_\_  
\_\_\_\_\_

Weather/Seasonality Observations: Partly cloudy; 50°F; calm.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #21: WR-1; #22: Adit #1; #23: Open stope at Upper Cleve; #24: WR-2A and -2B; #25: WR-2 from below. Video Tape No. 6  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

General Comments/Observations (not covered specifically in attached Inventory Forms): Upper Cleve adits and dumps added due to close proximity and contribution to erosion problems.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Other Hazardous Materials/Substances Present: N/A  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

General Comments on Potential Remedial Alternatives: Establish drainage around WR-1. Grade, ammend, and revegetate dumps; close HMOs.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): LOWER & UPPER CLEVE PA#: 01-143

Legal Description: T 3S ; R 11W ; Sec. 1 , NE1/4 SW1/4 1/4

County: BEAVERHEAD Mining District: HECLA

Latitude: N 45° 36' 14" Longitude: W 112° 54' 45"

Primary Drainage Basin and Code: Trapper Creek/10020004

Secondary Drainage Basin: Sappington Creek

USGS Quadrangle map name(s): Mount Tahepia

Mine Type/Commodities: Hardrock/Silver, Copper, Lead

Activity Status: Active      , Inactive/Exploration      , Abandoned X .

Ownership status: Known YX N ; private/public? Private

Owner, Agent, or Contact (Include address and phone when available): Robert Dundy,  
University of Mississippi, Jackson, MI 84047; Julius Levine, 1042  
McKeever Avenue, Hayward, CA 94541. (510) 733-5912.

Relationship to other mines/sites in the area/district: Entire  
Hecla district is located up Trapper Creek Road. Mine is located  
approx. 1/4 mile downstream of the Hecla mines and mill.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 8200' , Slope 3°-25° ,  
Aspect Southern

Land use: Mining X , Recreational X , Residential      , Urban      ,  
Agricultural X , Other (Specify)     

Area of disturbed/unvegetated lands? Approx. 1.5 acres.  
Dimensions:     

Predominant vegetation types: Douglas Fir, White Bark Pine,  
spruce, sage brush, grasses

Access: roads - good      , poor      , 4wd X , trail      .  
Other logistical considerations (proximity to other sites).

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). The mine is located near the headwaters  
of the North Fork of Sappington Creek. The Hecla basin is  
underlain by an igneous cupola. Ore was deposited in the overlying  
sediments by ascending metalliferous solutions emanating from the  
magma. No igneous rocks are known to crop out in the basin floor.  
Dolomitic limestone and quartz monzonite are abundant in the basin.

Mining/milling history, ore type/tenor, host rock, gangue: Mining  
began in the vicinity in the late 1870's. Some ore was milled at  
Lion City (Hecla Mill) in the 1910's. Concentrate was shipped to  
the smelter in Glendale. The Cleve deposit is a basalt dike. Ores  
consisted primarily of silver bearing cerussite and manganese  
oxides, stained by copper oxides in a gangue of quartz.  
Exploration/redevelopment has occurred in the last 10 to 20 years;  
last reported ore production was in the 1940's.

Mine Operation?

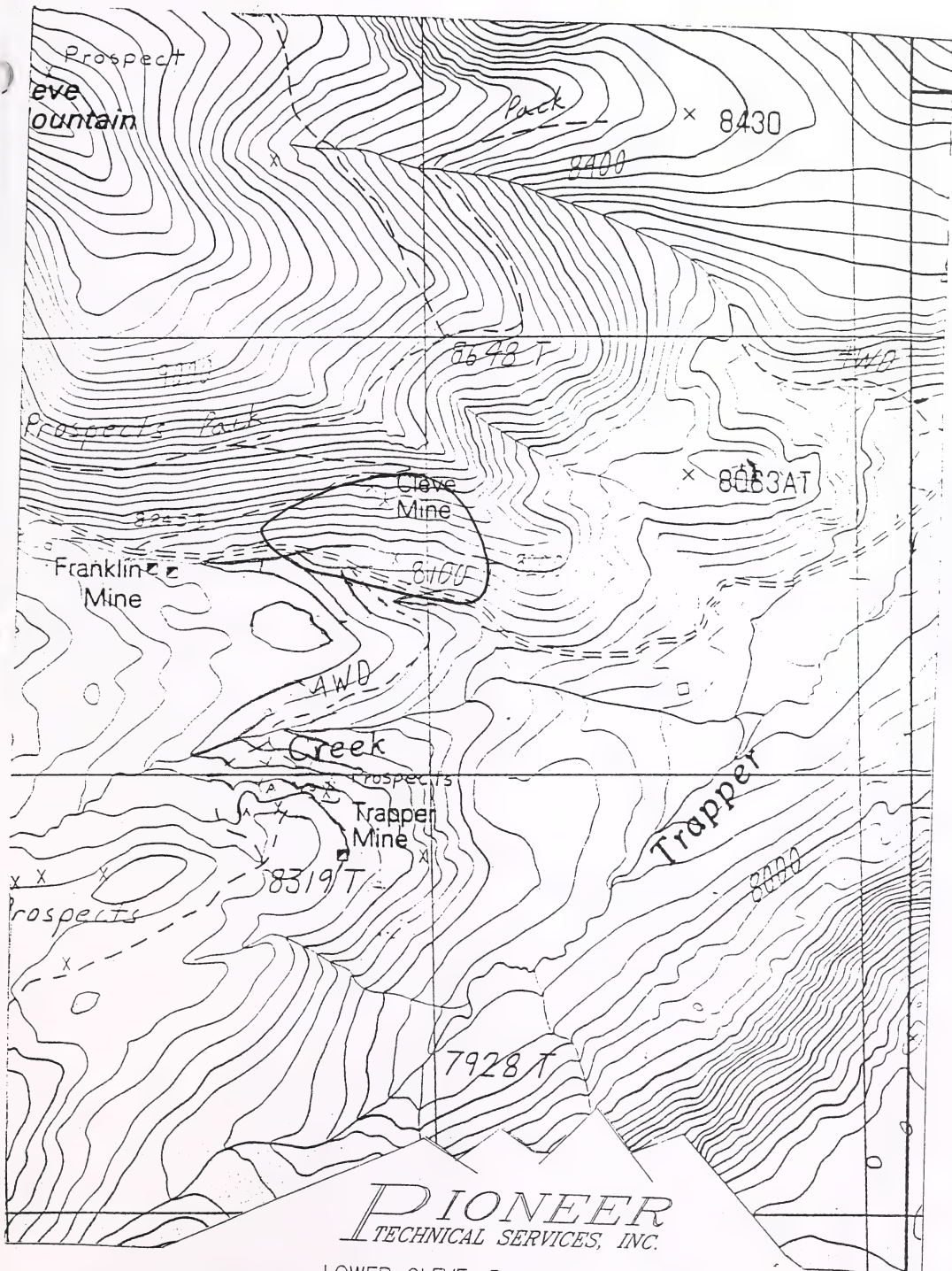
Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 2, Comment On Lower & Upper Cleve;  
open  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

Mill Operation? Yes     , No X. If yes answer the next three  
questions:

Period(s) of Operation: N/A

Origin of Ore Milled - Custom Mill      Dedicated Mill     ; Number and  
names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
N/A



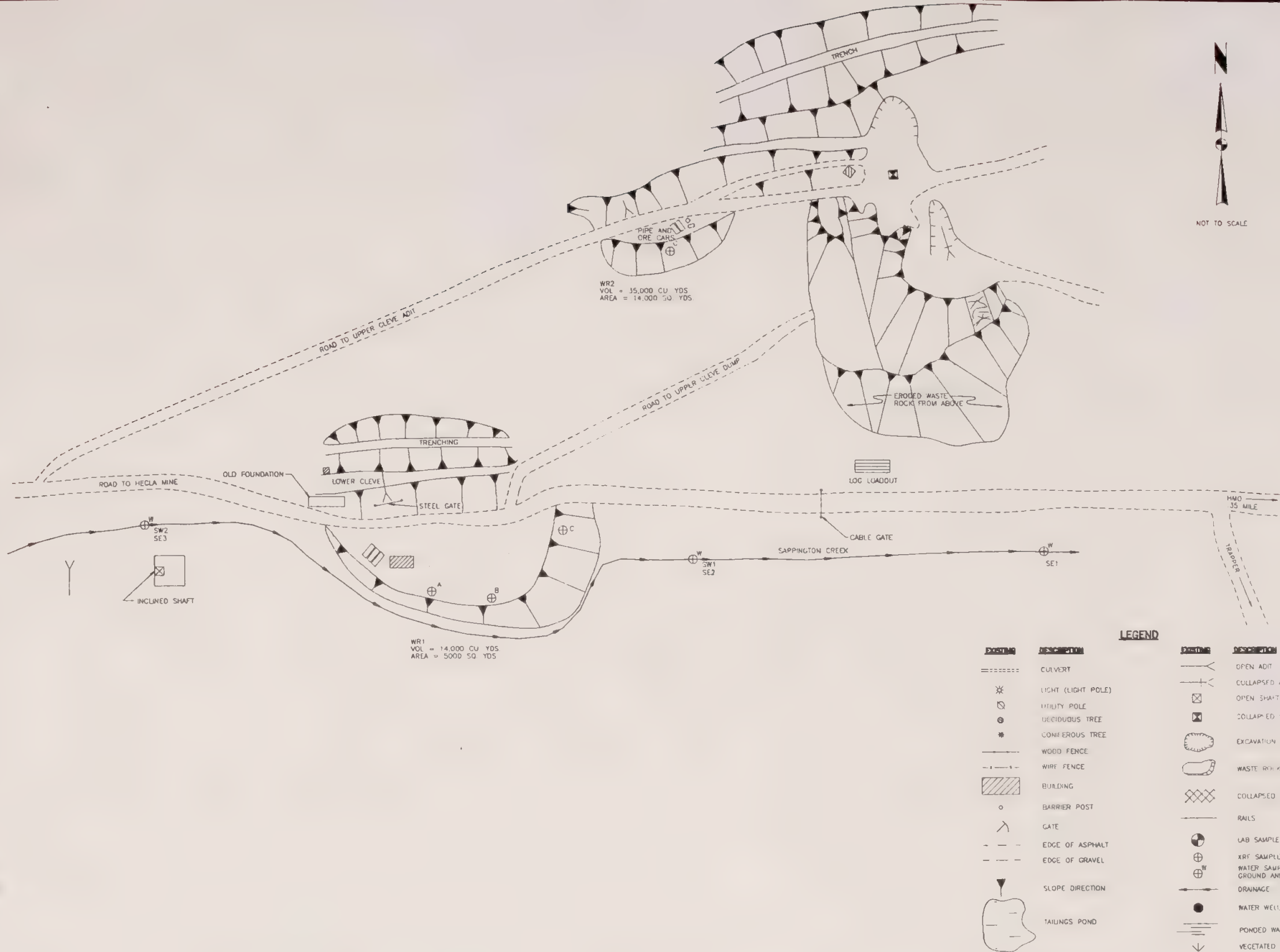
**PIONEER**  
TECHNICAL SERVICES, INC.

LOWER CLEVE, P.A. NO. 01-143

T03S, R11W, SECTION 01

SCALE: 1" = 1000'





NOT TO SCALE

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

LOWER CLEVE PA# 01-143  
HECLA DISTRICT BEAVERHEAD COUNTY

DRAWN: CAL DATE: 12/3/93  
DESIGNED: TPR JOB NO: 93-17  
APPROVED: WJB F.B. NO:

PIONEER  
TECHNICAL SERVICES, INC. BUTTE MT

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
SPOKANE MONTANA WASHINGTON

TS&H

1

1







## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A



SAMPLERS: Bullock, Pierson

Divalent cation ( $\text{Ca}^{2+}$  or  $\text{Mg}^{2+}$ ) : 0.5 g/liter water

MDSL AMRB/PIONEER 4/9/93

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Filled shafts: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Seeps/Springs: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Groundwater wells within 4 miles?: Yes X, No\_\_\_;  
Number of well logs: 1

Distance to nearest well used for drinking? > 4 miles

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite\_\_\_, Probable\_\_\_, Possible\_\_\_, Unlikely X.

Does not appear to be any water in the workings and even if present, abundant limestone would buffer the water.

Other observations/notes: N/A

### SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):



### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): Sappington Creek is flowing intermittently (partially on surface, partially in bed) through site.

Dry streambeds: Yes     , No X, Name(s):     

Other surface water: Yes     , No X, Name(s)/Description:     

Waste materials within any floodplain: Yes X, No      Source ID(s): WR-1 is in floodplain.

Approximate Flood frequency? X 1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)?       
High Flow: 1.5 cfs, Average Flow: 0.5-0.1 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet; WR-1 extends into Trapper Creek channel.

Surface water draining onto or through waste sources: Yes X, No     ,  
Describe: Severe runoff erosion gullies in WR-2; large volumes of material have been eroded into Trapper Creek.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Irrigation, stock watering, fishery.

Observed erosional/sedimentation/stream turbidity problems? Yes X,  
No     , Distance downstream (ft)? <1000' Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): High sediment load



**SAMPLERS:** Bullock, Pierson

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): SC and Temperature not measured due to instrument malfunction.

#### D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? Approx. 2 acres

Wetlands present: Yes , No X , Describe:

Carbonate rocks/soils: Yes X, No   , Describe: Dolomitic limestone  
very abundant in the area.

### E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 X; 10-30 \_\_\_\_; 30-100 \_\_\_\_;  
100-300 \_\_\_\_; 300-1,000 \_\_\_\_; 1,000-3,000 \_\_\_\_; 3,000-10,000 \_\_\_\_; 10,000 or  
greater \_\_\_\_; Comments \_\_\_\_\_

Nearest residence(ft or miles)? Recreational cabin approx. 1 mile

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:

observed	high	moderate	low	none
----------	------	----------	-----	------

SAMPLERS: Bullock, Pierson

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe:

Population within 1 mile: 1-10\_\_\_; 10-30\_\_\_; 30-100\_\_\_; 100-300\_\_\_;  
300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or greater\_\_\_;  
Comments None

Evidence of recreational use on site: Yes X, No   , Describe: Hikers  
and Mountain Bikers observed on previous day.

Accessibility - Fences, warning signs, closed roads? Cable gate, but  
sign states foot traffic is allowed.

**Sensitive environments on-site or adjacent to site:**

State or National Parks - Yes\_\_\_, No X, Comment\_\_\_\_\_

Wilderness Area - Yes\_\_\_, No X, Comment Near proposed boundry

T&E Species Habitat - Yes\_\_\_, No X, Comment\_\_\_\_\_

Bat Habitat - Yes X, No\_\_\_, Comment Upper & Lower adits

Primary Drainage X ; Secondary Drainage ; No Information :

Riparian Habitat Quality - High X, Medium   , Low     
Wetlands Frontage - High X, Medium   , Low     
Fisheries Habitat and Species Classification -   4    
Sport Fishery Classification - 4

## G. SAFETY CHARACTERISTICS

## Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No   , Number 5, types and locations: Two open adits: one at Lower Cleve; one at Upper Cleve. Plus one adit and one shaft open approx. 200 yds. west of the Cleve and one shaft open right next to road approx. 1 mile east of Cleve Mines.

Hazardous structures: Yes X, No     , Number 1, types and locations: Old core shack at the Lower Cleve.

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_, No X, Number\_\_\_,  
types and locations:

Unstable waste piles, impoundments, undercut banks: Yes X, No     ,  
Number 1, types and locations: WR-2 is severely eroded.

Fire and/or Explosion hazards: Yes , No X , Explain:

## Bibliography

MBMG, Mines and Mineral Deposits (Except Fuels), Beaverhead County, Montana, Bulletin No. 85, Author Unknown, April 1972.

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

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USGS, Topographic Map, Mount Tapheia, Montana, 7 1/2 minute Quadrangle, 1988.





LABORATORY ANALYTICAL DATA

LOWER AND UPPER CLEVE  
PA NO. 01-143



Lower Cleve PA# 01-143  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 09/14/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
01-143-SE-1	319 J	31.1	8.92	7.61	9.51	416	24800	3.51 J	542	19.5	1680	327 J	1310	NR
01-143-SE-2	162 J	22.8	14.70	4.89	11.9	522	12800	6.28 J	670	12.1	3930	135 J	2730	NR
01-143-SE-3	81.5 J	48.6	5.43	4.41	11.3	214	12500	1.88 J	704	14.7	1270	51.5 J	1230	NR
01-143-WR-1	615 J	22.7	51.00	3.11	5.68	1540	12700	16.6 J	6600	12.8	9770	352 J	7670	NR
01-143-WR-2	268 J	0.19 U	18.90	1.09	2.14	440	11500	8.97 J	878	4.36	1920	225 J	3310	NR
BACKGROUND	43	104	2.2	6.5	5.1	382	19200	0.085 J	582	3	56	4 UU	117	< 0.271

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL. ACID BASE		SULFUR POTENT.		PYRITIC ACID BASE		ORGANIC SULFUR		PYRITIC ACID BASE		SULFUR POTENT.	
	%	U/1000	%	U/1000	%	U/1000	%	U/1000	%	U/1000	%	U/1000	%	U/1000
01-143-WR-1	<0.01	0	482	482	<0.01	<0.01	0.01	0	0.01	0	0	0	482	482
01-143-WR-2	<0.01	0	497	497	<0.01	<0.01	0.01	0	0.01	0	0	0	497	497

WATER MATRIX ANALYSES

Metals in Water Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO <sub>3</sub> L)	HARDNESS CALC.
01-143-SW-1	3.09	13.1	4.59 U	5 U	6.24 U	2.33 U	13.7 U	0.23 J	3.76 U	10.9 U	2.58	31.7 U	15.6	159
01-143-SW-2	2.81	11.5	4.59 U	5 U	6.24 U	2.33 U	15.5	0.13 J	3.76 U	10.9 U	1.33	31.7 U	8.71 U	154

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS		CHLORIDE	SULFATE	NO <sub>3</sub> /NO <sub>2</sub> -N	CYANIDE
	193	< 5	< 5	< 5	0.1	NR
01-143-SW-1	193	< 5	< 5	< 5	0.1	NR
01-143-SW-2	199	< 5	< 5	< 5	0.1	NR

LEGEND

SE1 - Downgradient sediment; 650' below road to Trapper Mine in Sappington Creek.  
SE2 - 150' below waste rock dump 1 on Sappington Creek.  
SE3 - 110' above waste rock dump 1 on Sappington Creek.  
WR1 - Composite of subamples WR1A and 1C.  
WR2 - Composite of subamples WR2A and 2B.  
BACKGROUND - From the Indian Queen Mine (01-004-SS-1).

SW1 - 150' below waste rock dump 1 on Sappington Creek.  
SW2 - 110' above waste rock dump 1 on Sappington Creek.



XRF ANALYSIS RESULTS

LOWER AND UPPER CLEVE  
PA NO. 01-143





Mine Name: Lower Cleve PA# 01-143  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CHI	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-143-WR1-A		3097.59	147690	273.635 *		5810.5	19339.9		1690.47	10160.3		99.1256
01-143-WR1-B		1266.66	195784			773.557 *	2753.82			568.537		63.3629
01-143-WR1-C		1601.53 *	180502			6912.14	8886.36		1050.17	3905.77		81.684
01-143-WR2-A		6125.02	189023	286.107 *		2467.21	10156.4		605.554	4112.19		114.159
01-143-WR2-B		12798.1	31789.1	576.684			14334.2		82.0181 *	706.831		113.292
01-143-WR2-C		111294		1315.22		389.521 *	12501.8			180.828	89.6894 *	144.236
01-143-WR-1-COMP		1803.86 *	162333			5511.47	11012.1		1435.23	5762.64		83.8613
01-143-WR-2-COMP		2422.24	136888	268.691 *		1573.89	13788.3		427.257	2591.6		108.786
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-143-WR1-A	42.4191		4.86887 *	6096.75	52.8616 *		686.453	62.8036 *	153.87 *		19.8731 *	
01-143-WR1-B	7.13448 *		4.54479 *	299.869	13.6966 *							
01-143-WR1-C	20.4969		8.67233 *		31.7779 *						15.4303 *	
01-143-WR2-A	21.8293			1833.56	25.2706 *	188.712 *	508.545		161.706 *			
01-143-WR2-B	79.0921		3.66367 *	1044.53	32.9116 *		397.031					
01-143-WR2-C	120.388		23.3529	39.856 *	62.6504		414.808	34.9239 *	96.0482 *		11.0773 *	
01-143-WR-1-COMP	28.6193		8.34229 *	5193.53	25.3416 *	191.212 *	512.695	123.744			8.44874 *	
01-143-WR-2-COMP	40.1177		4.03476 *	1343.7	26.0561 *		574.381		141.354 *			
							385.323		153.153 *			

\* - Estimated Quantity  
\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

LOWER CLEVE  
PA NO. 01-143



# **AIMSS SCORESHEET**

SITE NAME: LOWER AND UPPER CLEVE  
PA NUMBER: 01-143

LINE NO.		GROUNDWATER PATHWAY	
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	20
3B		GW DEPTH	20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
6			177.377
7	GW - TARGETS	WELLS - 1 MI. x 2.5	0.0
8		WELLS - 1 TO 4 MI	1
9		NEAREST WELL	0
10		TARGETS SCORE	LINES 6 + 7 + 8
			1.0
		GROUNDWATER SCORE	LINES 4 x 5 x 9
			70951
<b>SURFACE WATER PATHWAY</b>			
11		OBSERVED RELEASE	300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES	0
13A		CONTAINMENT	20
13B		DISTANCE TO SW	0
13C		POTENTIAL TO RELEASE	LINES 13A x 13B
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
16			193.530
17	SW - TARGETS	DRINKING WATER POP'N	0
18		IMPACTED DRAINAGE	1
19		WETLANDS	0
20		FISHERY	1
21		RECREATION	5
22		IRRIGATION/STOCK	2
23		T & E SPECIES HABITAT	0
24		TARGETS SCORE	SUM LINES 16 - 22
			9
		SURFACE WATER SCORE	LINES 14 x 15 x 23
			522531
<b>AIR PATHWAY</b>			
25		OBSERVED RELEASE	0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT	10
26B		DISTANCE TO POPULATION	5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B
27		LIKELIHOOD SCORE	LINES 25 + 26C
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
29			3.714
30	AIR - TARGETS	POPULATION - 4 MILES	1
31		NEAREST RESIDENCE	0
32		WETLANDS	10
33		PARKS / WILDERNESS	0
34		T & E SPECIES HABITAT	0
35		TARGETS SCORE	SUM LINES 29 - 33
			11
		AIR PATHWAY SCORE	LINES 27 x 28 x 34
			2043
<b>DIRECT CONTACT PATHWAY</b>			
36		OBSERVED EXPOSURE	50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY	10
37B		DISTANCE TO POPULATION	5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B
38		LIKELIHOOD SCORE	LINES 36 + 37C
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
40			3.412
41	DIRECT CONTACT TARGETS	POPULATION - 1 MILE	0
42		NEAREST RESIDENCE	0
43		RECREATIONAL USE	10
44		TARGETS SCORE	SUM LINES 40 - 42
			10
		DIRECT CONTACT SCORE	LINES 38 x 39 x 43
			3412
45	TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE		
	(LINES 10 + 24 + 35 + 44) / 100,000		5.99

LINE  
NO.

SITE NAME: LOWER AND UPPER CLEVE

PA NUMBER: 01-143

**SITE SAFETY**

1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	200
3		OPEN ADITS	50 EA.	150
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	40
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	390
9		POPULATION - 1 MILE		0
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		10
12		TARGETS SCORE	SUM LINES 9 - 11	10
13		SITE SAFETY SCORE	(LINES 1 x 8 x 12) / 1,000	39.00





01-143, #21: WR-1



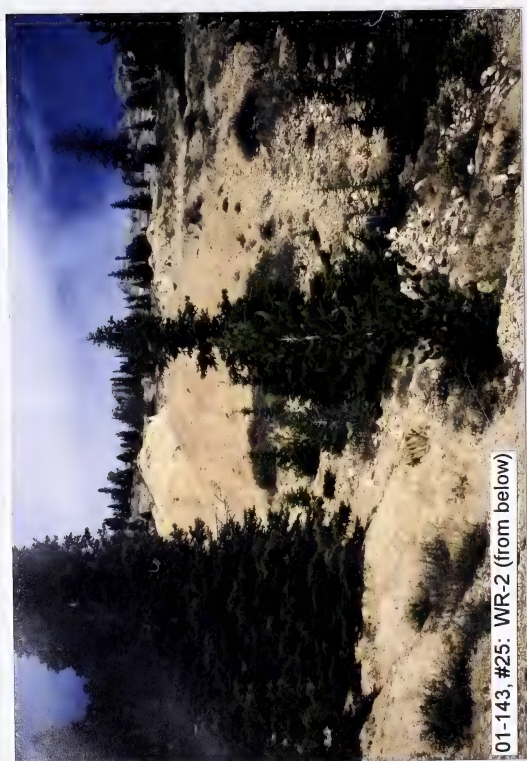
01-143, #22: Adit #1



01-143, #23: Open stope



01-143, #24: WR-2A and WR-2B



01-143, #25: WR-2 (from below)



MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: TRAPPER PA#: 01-144

Date: August 26, 1993 Time: 1300-1730

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Tuesday, Pioneer

Visitors: None

Weather/Seasonality Observations: Partly cloudy; 50°F; slight breeze; cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #23: Adit #2; #24: WR-2; #25: Adit #1; #26: WR-1; #27: Mill; #28: TP-1; #29: TP-2; #30: TP-3; #31: SW-1; #32: SW-2. Video Tape No. 6

General Comments/Observations (not covered specifically in attached Inventory Forms): N/A

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Remove tailings from the drainage. Amend and revegetate mine wastes. Raze hazardous structures.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): TRAPPER PA#: 01-144

Legal Description: T 3S ; R 11W ; Sec. 12 , NW1/4 NW1/4 1/4

County: BEAVERHEAD Mining District: HECLA

Latitude: N 45° 35' 45" Longitude: W 112° 54' 52"

Primary Drainage Basin and Code: Trapper Creek/10020004

Secondary Drainage Basin: North Fork of Sappington Creek

USGS Quadrangle map name(s): Mount Tahepia

Mine Type/Commodities: Hardrock/Gold, Silver, Lead, Copper

Activity Status: Active      , Inactive/Exploration      , Abandoned X .

Ownership status: Known YX N ; private/public? Private

Owner, Agent, or Contact (Include address and phone when available): Lowell Potter, 428 Pepperidge, Midvale, UT 84047.

Relationship to other mines/sites in the area/district: Within close proximity to the Cleve mine.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 8200' , Slope 3°-25° ,  
Aspect Northern

Land use: Mining X , Recreational X , Residential      , Urban      ,  
Agricultural      , Other(Specify)     

Area of disturbed/unvegetated lands? 0.75 acres.  
Dimensions:     

Predominant vegetation types: Lodgepole pine, Engleman spruce

Access: roads - good      , poor      , 4wd X , trail      .  
Other logistical considerations (proximity to other sites).

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

20  
47

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). The mine and mill are located approx. 1  
mile below the headwaters of Sappington Creek. The Hecla basin is  
underlain by an igneous cupola. Ore was deposited in the overlying  
sediments by ascending metalliferous solutions emanating from the  
magma. No igneous rocks are known to crop out in the basin floor.  
Dolomitic limestone and quartz monzonite are abundant in the basin.

Mining/milling history, ore type/tenor, host rock, gangue: The  
Trapper lode was discovered in 1875; literature does not mention  
the mill or when it was constructed/operated. The mine produced  
4,320 tons of ore between 1877 and 1899, containing 346 oz. gold;  
614,713 oz. silver; 4,516,789 lbs. lead; and, 312,003 lbs. copper.  
The ore deposits occur in small fissures and as bedding vein  
replacements in the dolomitic upper part of the Meagher formation  
between quartzitic layers.

Mine Operation?

Shafts - Yes     , No X, #     , Comment Shaft on topographic map  
could not be located.  
Adits - Yes X, No     , # 2, Comment Caved  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

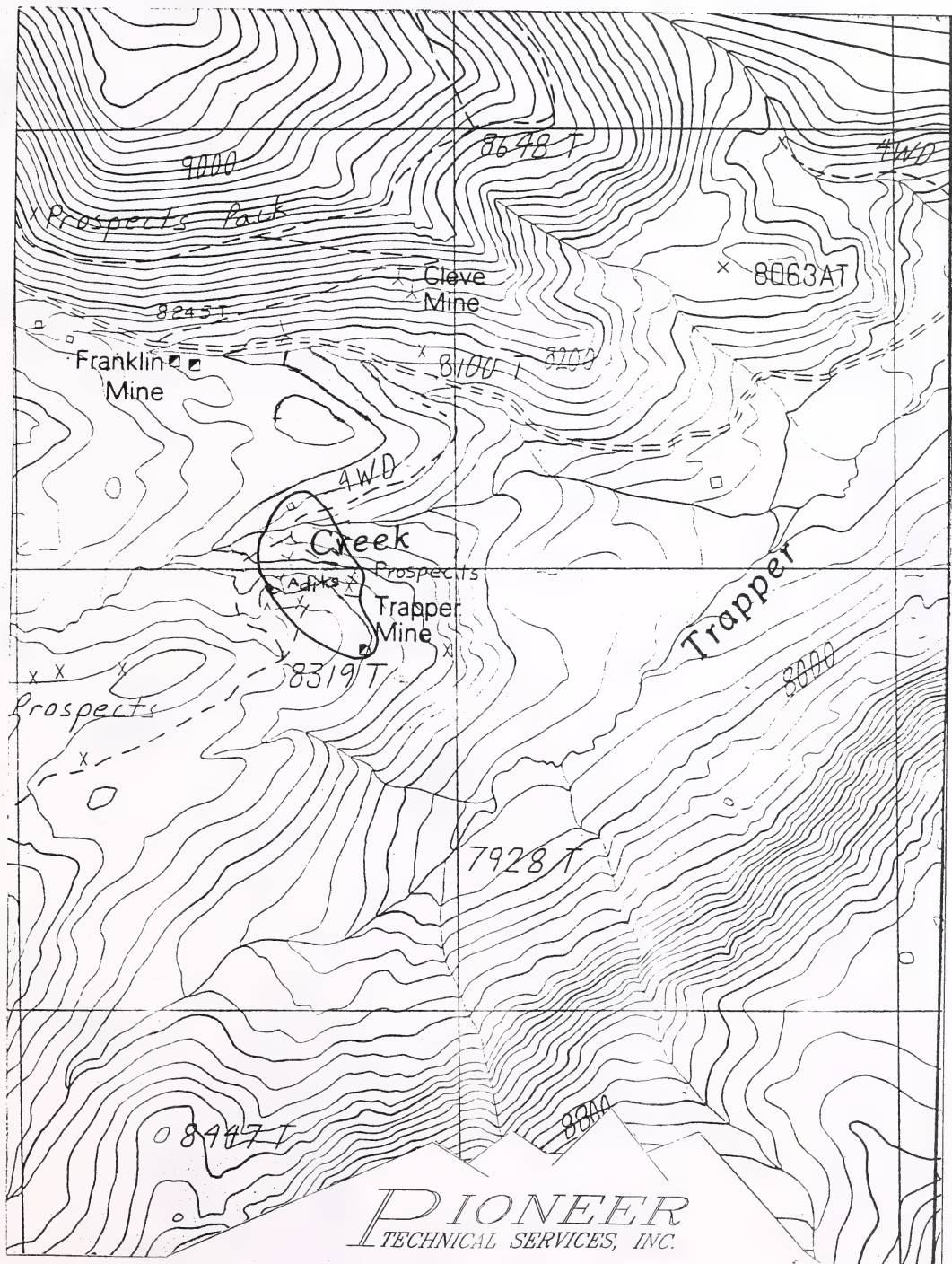
Mill Operation? Yes X, No     . If yes answer the next three  
questions:

Period(s) of Operation: No information available

Origin of Ore Milled - Custom Mill      Dedicated Mill X; Number and  
names of mines that supplied mill feed: Appears to be a small,  
dedicated mill.

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
Probably floatation





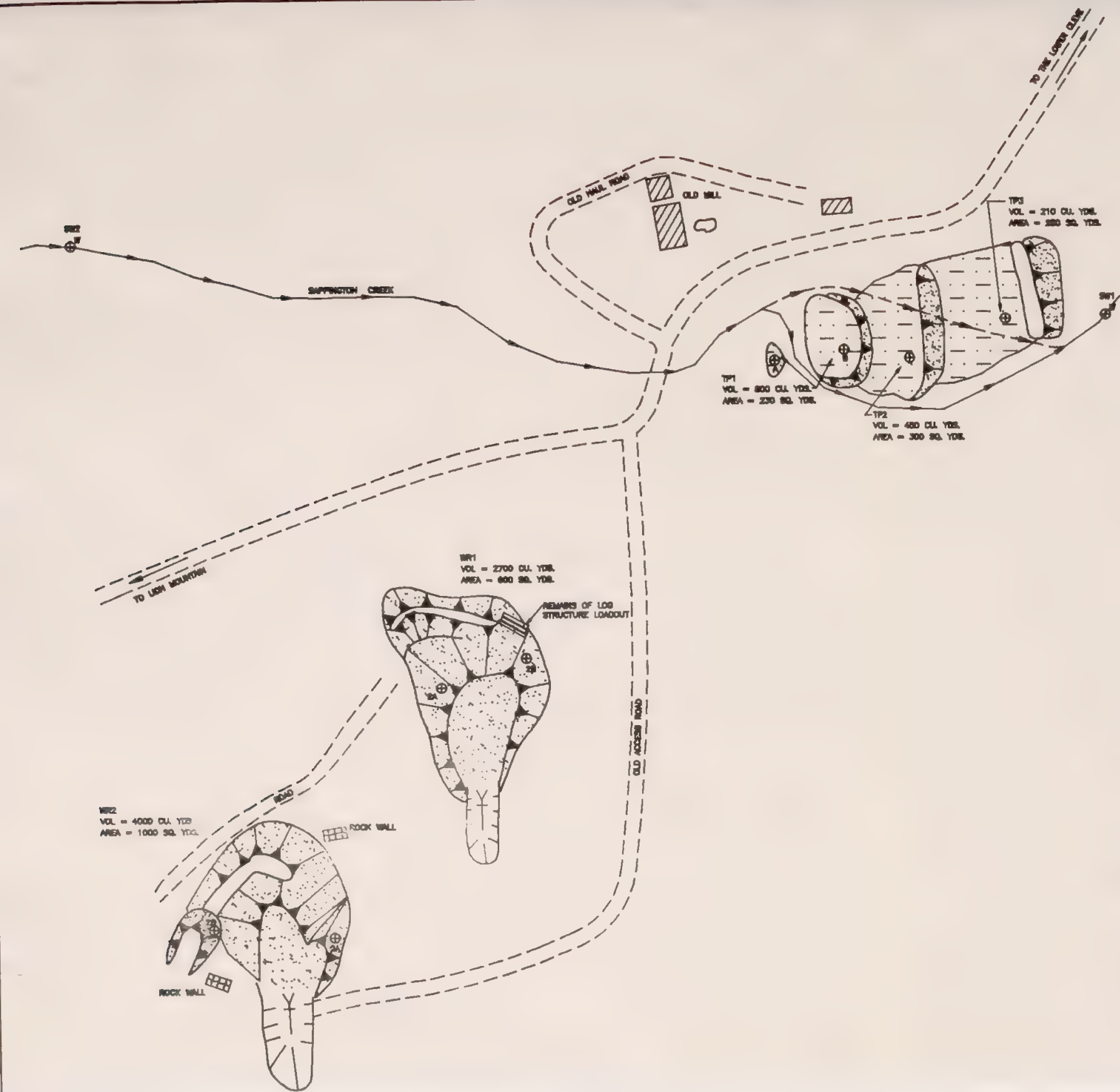
**PIONEER**  
TECHNICAL SERVICES, INC.

TRAPPER, P.A. NO. 01-144

T03S, R11W, SECTION 12

SCALE: 1" = 1000'

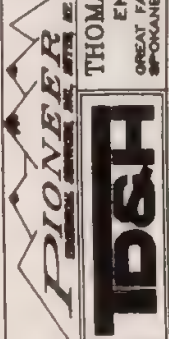




MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY  
TRAPPER MINE MILL PA# 01-144  
HECLA DISTRICT BEAVERHEAD COUNTY

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON

DRAWN: CAI DATE: 12/7/93  
DESIGNED: TFR JOB NO.: 93-17  
APPROVED: MJB F.B. NO.



SHEET NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
Approx. 60% medium to coarse sand and 40% silty sand.

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Tan to brown sand throughout

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Tails are dry near surface and wet at depth.

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Stream flows over tailings during high flows and has breached impoundments.

Comments on potential for mitigation: Remove from drainage and amend or encapsulate.





# **SOURCE INVENTORY FORM**

SAMPLERS: Bullock, Tuesday

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	PH SU (D/S)*	RADIO-ACTIVITY (MR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
WR-1A	WR	2,700	Lower dump, west side; brown sand	None	6.8 (D)	0.025	01-144-WR-1	08/26/93 2200	T-Metals, ABA
WR-1B	WR		Lower dump, east side; orange sand	None	6.8 (D)	0.04			
WR-2A	WR	4,000	Upper dump, east side; tan sand	None	6.8 (D)	0.02			
WR-2B	WR		Upper dump, west side; brown sand	None	6.8 (D)	0.035			
TP-1A	TAIL	800	Streamside tails above pond; 0-12', brown sand	Streamside	6.9 (D)	0.035			
TP-1B	TAIL		Upper pond, north side; 0'-1.5', brown sand	Breached Dam	6.3 (D)	0.03	01-144-TP-1	08/26/93 1430	T-Metals, ABA
TP-2A-A	TAIL	450	Second pond, center; 0'-2.5', coarse tan sand	Breached Berm	6.1 (D)	0.03			
TP-2A-B	TAIL		Second pond, center; 2.5'-4', brown wet silty sand	Breached Berm	4.9 (D)	0.03			
TP-3A-A	TAIL	210	Lowest pond, center; 0'-1.5', coarse brown sand	Breached Berm	5.8 (D)	0.035			
TP-3A-B	TAIL		Lowest pond, center; 1.5'-2.5', fine brown/green sandy silt	Breached Berm	5.9 (D)	0.035	01-144-TP-2	08/27/93 1430	T-Metals, ABA

\*D-Direct reading(Kelway Meter); S-Saturated Paste(Orion Meter)

**Comments or deviations from SOPs:** 01-144-WR-1 is composite of WR-1A and -1B, and WR-2A and -2B. 01-144-TP-1 is composite of TP-1B, TP-2A-A, and TP-3A-A. 01-144-TP-2 is composite of TP-2A-B and TP-3A-B.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_

Filled shafts: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_

Seeps/Springs: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_

Groundwater wells within 4 miles?: Yes\_\_\_, No X;  
Number of well logs: 0

Distance to nearest well used for drinking? > 4 miles

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite\_\_\_, Probable\_\_\_, Possible X, Unlikely\_\_\_.

Possible for groundwater contamination due to leaching from waste rock and tailings.

Other observations/notes: N/A

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): Main Fork of Sappington Creek

Dry streambeds: Yes     , No X, Name(s):                     

Other surface water: Yes     , No X, Name(s)/Description:                     

Waste materials within any floodplain: Yes X, No      Source ID(s): TP-1 and TP-3

Approximate Flood frequency?      1 yr, X 10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)?                       
High Flow: 10 cfs, Average Flow: 2 cfs

Distance between waste source(s) and nearest surface water body (ft)?       
Streamside tailings, 0 feet to TP-1A; impoundments are 5 to 15 feet from stream.

Surface water draining onto or through waste sources: Yes X, No     ,  
Describe: Stream flows through tailings during high flow events.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Irrigation, stock watering, fishery

Observed erosional/sedimentation/stream turbidity problems? Yes X, No     , Distance downstream (ft)? >1000 Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Heavy sediment lodges in stream.



SAMPLERS: Tuesday

[illegible]

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993): NC = Not Collected.

#### D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

##### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

##### General Potential for AMD Mitigation:

Area available for treatment (acres)? 1 acre of level floodplain where tailings are located; stream drops off into a steeper gradient below the tailings.

Wetlands present: Yes X, No     , Describe: Very small (approx. 0.1 acre) wetlands adjacent to upper tailings.

Carbonate rocks/soils: Yes X, No     , Describe: Dolomitic limestone is abundant.

#### E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 X; 10-30     ; 30-100     ; 100-300     ; 300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ; Comments     

Nearest residence(ft or miles)? 1 mile to recreational cabin

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



# ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Bullock, Tuesday

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/FIRED/NO DEBRATE/LOW/HIGH)
WR-1	None	Dry	7,200	7,200	Yes	Low
WR-2	None	Dry	9,000	9,000	Yes	Low
TP-1	None	Partial	2,070	1,860	Yes	Low
TP-2	Low pH	Partial	2,700	1,350	Yes	Low
TP-3	None	Partial	2,250	900	Yes	Low

Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe:

Population within 1 mile: 1-10\_\_\_; 10-30\_\_\_; 30-100\_\_\_; 100-300\_\_\_;  
300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or greater\_\_\_;  
Comments None

Evidence of recreational use on site: Yes X, No   , Describe: Off-road vehicle tracks; litter

Accessibility - Fences, warning signs, closed roads? Unrestricted;  
there is a "Private Property" sign 1/4 mile down road.

**Sensitive environments on-site or adjacent to site:**

State or National Parks - Yes\_\_\_, No X, Comment\_\_\_\_\_

Wilderness Area - Yes\_\_\_, No X, Comment\_\_\_\_\_

T&E Species Habitat - Yes\_\_\_, No X, Comment\_\_\_\_\_

Bat Habitat - Yes\_\_\_, No X, Comment\_\_\_\_\_

Primary Drainage X ; Secondary Drainage ; No Information :

Riparian Habitat Quality - High X, Medium   , Low     
Wetlands Frontage - High X, Medium   , Low     
Fisheries Habitat and Species Classification -   4    
Sport Fishery Classification - 4

## G. SAFETY CHARACTERISTICS

## Verify completeness of AMRB Inventory

Hazardous openings: Yes , No X , Number , types and locations:

Hazardous structures: Yes X, No     , Number 2, types and locations: Old mill and cabin

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_, No X, Number\_\_\_,  
types and locations:

Unstable waste piles, impoundments, undercut banks: Yes X, No     ,  
Number All, types and locations: Tailings ponds are unstable and waste  
rock piles are oversteepened.

Fire and/or Explosion hazards: Yes X , No , Explain: Structures

## Bibliography

- MBMG, Mines and Mineral Deposits (Except Fuels), Beaverhead County, Montana, Bulletin 85, Written by R.D. Geach, April 1972.
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- MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Trapper, Prepared by Northern Engineering and Testing, June 17, 1987.
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LABORATORY ANALYTICAL DATA

TRAPPER  
PA NO. 01-144





Trapper PA# 01-144  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 09/15/93

SOLID MATRIX ANALYSES

Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
01-144-SE-1	11.1	13.4 J	0.987 UJ	3.48	8.27 JX	22.1	7640	0.181 J	302 J	9.57 JX	374 JX	10.9 J	206 J	NR
01-144-SE-2	5.62	12.4 J	0.953 UJ	2.37	3.14 JX	0.484 U	3920	0.038 UJ	251 J	2.55 JX	6.81 UJX	6.58 UJ	22.7 J	NR
01-144-TP-1	818 J	4.92	65.9 J	2.78	6.58	2570	10200	39.6 J	811	16.3	7860	463	21800	NR
01-144-TP-2	1260 J	32.5	110 J	6.71	16.8	3980	18500	85.8 J	1770	34.3	13600	536	24200	NR
01-144-WR-1	505 J	0.187 U	96.2 J	2.46	1.48	0.396 U	7240	34.3 J	1180	10.6	5.58 U	157	1060	NR
BACKGROUND	43	104	2.2	6.5	5.1	382	19200	0.085 J	582	3	56	4 UJ	117	<0.271

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE %	TOTAL SULFUR %	NEUTRAL %	SULFUR ACID BASE POTENTIAL	SULFATE %	ORGANIC %	PYRITIC %	ACID BASE POTENTIAL
01-144-TP-1	0	1	188	187	0	0	<0.01	0	188
01-144-TP-2	0	1	136	135	<0.01	0	0	1	135
01-144-WR-1	0	2	888	886	0	0	0	0	888

WATER MATRIX ANALYSES

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC (mg CaCO3/L)
01-144-SW-1	1.12 U	32.8	4.59 U	5 U	6.24 U	2.33 U	31.1 J	0.22	3.76 U	10.9 U	1.02	31.7 U	11.4	152
01-144-SW-2	1.12 U	31.1	4.59 U	5 U	6.24 U	2.33 U	36.3 J	0.2	5.8	10.9 U	0.94 U	31.7 U	8.71 U	168

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry

Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
01-144-SW-1	179 <	5.0	6	< 0.05	NR
01-144-SW-2	169 <	5.0	<	5	NR

LEGEND

- SE1 - Sappington Creek 200 feet below last tailings pond.  
SE2 - Sappington Creek 100 feet upstream from waste rock.  
TP1 - Composite of subsamples TP1B, 2AA, and 3AA.  
TP2 - Composite of subsamples TP2AB and 3AB.  
WR1 - Composite of subsamples WR1A, 1B, 2A, and 2B.  
BACKGROUND - From Indian Queen Mine (01-034-S5-1).
- SW1 - Same as sample SE1.  
SW2 - Same as sample SE2.



XRF ANALYSIS RESULTS

TRAPPER  
PA NO. 01-144



XRF Field Analyses

Results in PPM

XRF SAMPLE ID	CHI	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-144-TP1-A		593.618 *	151401			929.604 *	15953.2		305.543	2918.42		113759
01-144-TP1-B		5524.81	73789.2	612.656		1042.97 *	15466.3		2345.88	16753.3		81.3849
01-144-TP2A-A		2500.45	87392	315.452 *		679.145 *	12373.2		1681.27	11997.2		66.5406
01-144-TP2A-B		14274.5	45704.1	1177.52		3080.35	27962.2		4719.44	25665.6		77.9511
01-144-TP3A-A		4934.3	86572.7	512.183		508.829 *	8213.72		1457.67	13771.6		75.3181
01-144-TP3A-B		21050.2	56026.7	1849.97		1134.1 *	24227.4		3449.47	23636		99.9724
01-144-TP-1-COMP		8623.16	85335.6	902.863		867.275 *	15040.9		2516.22	16849.3	216.548 *	77.5664
01-144-TP-2-COMP		16243.4	54725.6	1528.24		1609.86	23706.7		3608.08	22900.8		94.8971
01-144-WR1-A		1485.64 *	153310	142.245 *		1650.04	10914.3		379.912	2727.14		118.661
01-144-WR1-B		180915				990.007 *	15417.6		463.832	5763.15		153.2
01-144-WR2-A		144077				635.732	1588.9		175.885	764.584		124.994
01-144-WR2-B		174190		302.092		644.529 *	12175.3		392.721	929.88		128.597
01-144-WR-1-COMP		162702				1010.65 *	9838.72		358.895	2119.6		125.602
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-144-TP1-A	9.77554 *			1849.21	13.3389 *		241.592		158.472 *			
01-144-TP1-B	77.6942	83.1963 *		5953.75	41.8539 *		977.559	57.3109 *	221.835 *		22.5689 *	
01-144-TP2A-A	32.9232	61.321 *		3722.37	29.3967 *		584.962	25.9529 *	116.695 *			
01-144-TP2A-B	102.915	68.7873 *		11942.6	83.5474		1688.22	110.61	372.113 *		24.1837 *	
01-144-TP3A-A	39.221			3847.12	28.4231 *	181.83 *	711.78		157.036 *		14.462 *	
01-144-TP3A-B	151.085	86.9842 *		9556.46	95.5958		1323.11	163.545	348.056 *		30.2121 *	
01-144-TP-1-COMP	67.5451	49.8355 *		6141.55	37.9708 *	205.39 *	895.482	31.3395 *	274.191 *		17.2354 *	
01-144-TP-2-COMP	131.692	70.3027 *		9828.25	77.6038		1335.97	126.447	219.398 *			
01-144-WR1-A	16.3998 *			2404.99			222.969		176.926 *			
01-144-WR1-B	7.60508 *			2971.73	14.7818 *		261.424		150.817 *		2.82724	
01-144-WR2-A	4.04901			635.851	7.42446		148.479		39.2806			
01-144-WR2-B	6.27444 *			2905.09			600.885		124.864 *			
01-144-WR-1-COMP	5.23951 *			1827.03	12.7175 *		311.915		158.696 *			

\* - Estimated Quantity

\$ - Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

TRAPPER  
PA NO. 01-144



# **AIMSS SCORESHEET**

SITE NAME:

PA NUMBER:

TRAPPER

01-144

LINE  
NO.

## **GROUNDWATER PATHWAY**

1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	20
3B		GW DEPTH	20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B 400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C 400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET) 9.675
6	GW - TARGETS	WELLS - 1 MI. x 2.5	0.0
7		WELLS - 1 TO 4 MI	0
8		NEAREST WELL	0
9		TARGETS SCORE	LINES 6 + 7 + 8 0.0
10		<b>GROUNDWATER SCORE</b>	LINES 4 x 5 x 9 0

## **SURFACE WATER PATHWAY**

11	SW - LIKELIHOOD OF RELEASE	OBSERVED RELEASE	300
12		EXCEEDENCES	0
13A		CONTAINMENT	20
13B		DISTANCE TO SW	20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B 400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C 700
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET) 10.525
16	SW - TARGETS	DRINKING WATER POP'N	0
17		IMPACTED DRAINAGE	1
18		WETLANDS	10
19		FISHERY	1
20		RECREATION	5
21		IRRIGATION/STOCK	2
22		T & E SPECIES HABITAT	0
23		TARGETS SCORE	SUM LINES 16 - 22 19
24		<b>SURFACE WATER SCORE</b>	LINES 14 x 15 x 23 139983

## **AIR PATHWAY**

25	AIR - LIKELIHOOD OF RELEASE	OBSERVED RELEASE	0
26A		CONTAINMENT	10
26B		DISTANCE TO POPULATION	5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B 50
27		LIKELIHOOD SCORE	LINES 25 + 26C 50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET) 0.180
29	AIR - TARGETS	POPULATION - 4 MILES	1
30		NEAREST RESIDENCE	0
31		WETLANDS	10
32		PARKS / WILDERNESS	0
33		T & E SPECIES HABITAT	0
34		TARGETS SCORE	SUM LINES 29 - 33 11
35		<b>AIR PATHWAY SCORE</b>	LINES 27 x 28 x 34 99

## **DIRECT CONTACT PATHWAY**

36	LIKELIHOOD OF EXPOSURE	OBSERVED EXPOSURE	50
37A		ACCESSIBILITY	10
37B		DISTANCE TO POPULATION	5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B 50
38		LIKELIHOOD SCORE	LINES 36 + 37C 100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET) 0.167
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE	0
41		NEAREST RESIDENCE	0
42		RECREATIONAL USE	2
43		TARGETS SCORE	SUM LINES 40 - 42 2
44		<b>DIRECT CONTACT SCORE</b>	LINES 38 x 39 x 43 33

45 TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE  
(LINES 10 + 24 + 35 + 44) / 100,000

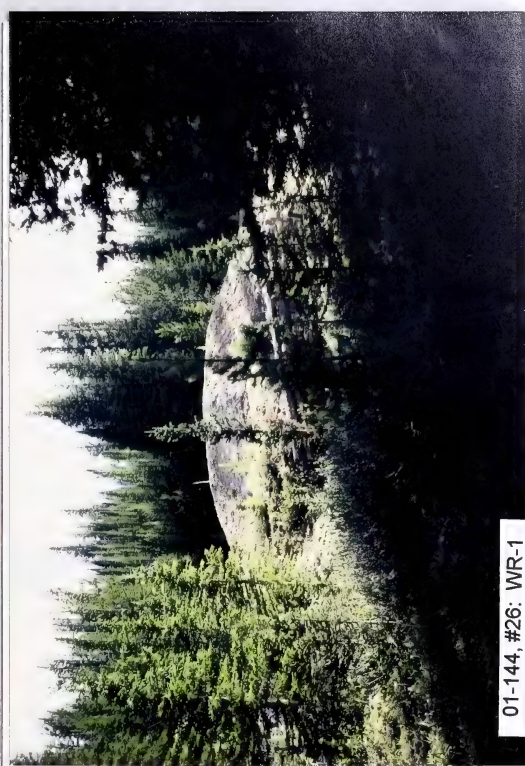
1.40

LINE NO.			SITE NAME:	TRAPPER
			PA NUMBER:	01-144
		<b>SITE SAFETY</b>		
1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	80
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	80
9		POPULATION - 1 MILE		0
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		2
12		TARGETS SCORE	SUM LINES 9 - 11	2
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>1.60</b>





01-144, #24: WR-2



01-144, #26: WR-1



01-144, #23: Adit #2



01-144, #25: Adit #1





01-144, #28: TP-1



01-144, #30: TP-3

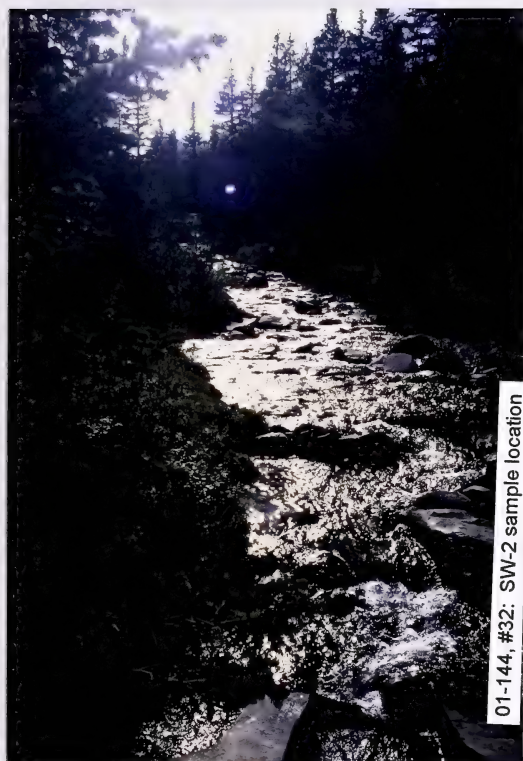


01-144, #27: Mill building

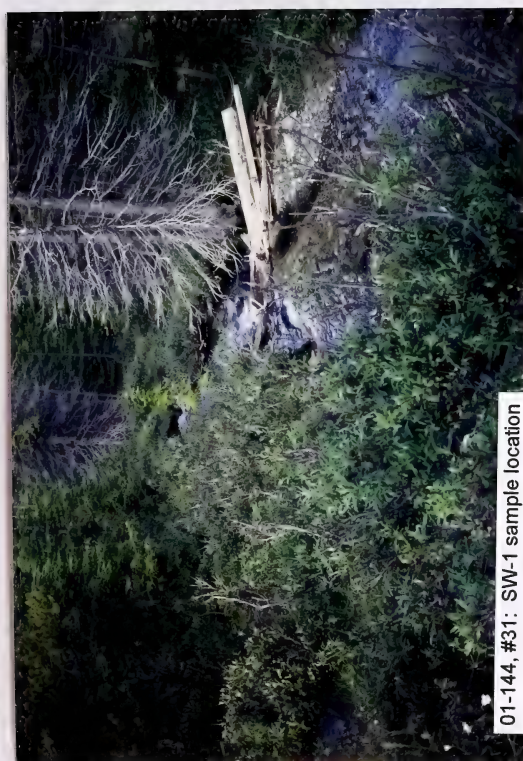


01-144, #29: TP-2





01-144, #32: SW-2 sample location



01-144, #31: SW-1 sample location







MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: SOUTH FRYING PAN CREEK PA#: 01-211

Date: August 25, 1993 Time: 1230

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Tuesday, Pioneer

Visitors: Tim Pfahler, MDSL Helicopter Pilot

Weather/Seasonality Observations: Sunny; cool

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #19: South Frying Pan Creek mine adit; #20: SW-2 sample location; #21: WR-1, looking west; #22: SW-1 sample location. Video Tape No. 5

General Comments/Observations (not covered specifically in attached Inventory Forms): N/A

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Remove waste from drainage, cover and vegetate.





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): SOUTH FRYING PAN CREEK PA#: 01-211

Legal Description: T 10S ; R 15W ; Sec. 28 , NE1/4 NW1/4 1/4

County: BEAVERHEAD Mining District: LEMHI PASS

Latitude: N 45° 56' 15" Longitude: W 113° 26' 56"

Primary Drainage Basin and Code: Frying Pan Creek/10020001

Secondary Drainage Basin: South Frying Pan Creek

USGS Quadrangle map name(s): Lemhi Pass

Mine Type/Commodities: Hardrock/Unknown

Activity Status: Active     , Inactive/Exploration     , Abandoned X .

Ownership status: Known YX N ; private/public? Public

Owner, Agent, or Contact (Include address and phone when available): BLM

Relationship to other mines/sites in the area/district: Downstream  
1/2 mile from Last Chance No. 2 site.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? Some fencing around waste dump next  
to road.

General site features: Elevation 7000' , Slope 23° ,  
Aspect South

Land use: Mining X , Recreational X , Residential X , Urban     ,  
Agricultural     , Other (Specify)    

Area of disturbed/unvegetated lands? 1 acres.  
Dimensions: 108 feet x 35 feet

Predominant vegetation types: Grasses, sage

Access: roads - good X , poor     , 4wd     , trail     .  
Other logistical considerations (proximity to other sites). Last  
Chance No. 2 is in the same drainage.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Dump is only 35 feet from the north side  
of South Frying Pan Creek. South Frying Pan Creek flows east past  
the site to Frying Pan Creek 1 mile downstream. Frying Pan Creek  
meets Trail Creek 2 1/2 miles downgradient by the Selway Ranch.

Mining/milling history, ore type/tenor, host rock, gangue: No  
information available.

Mine Operation?

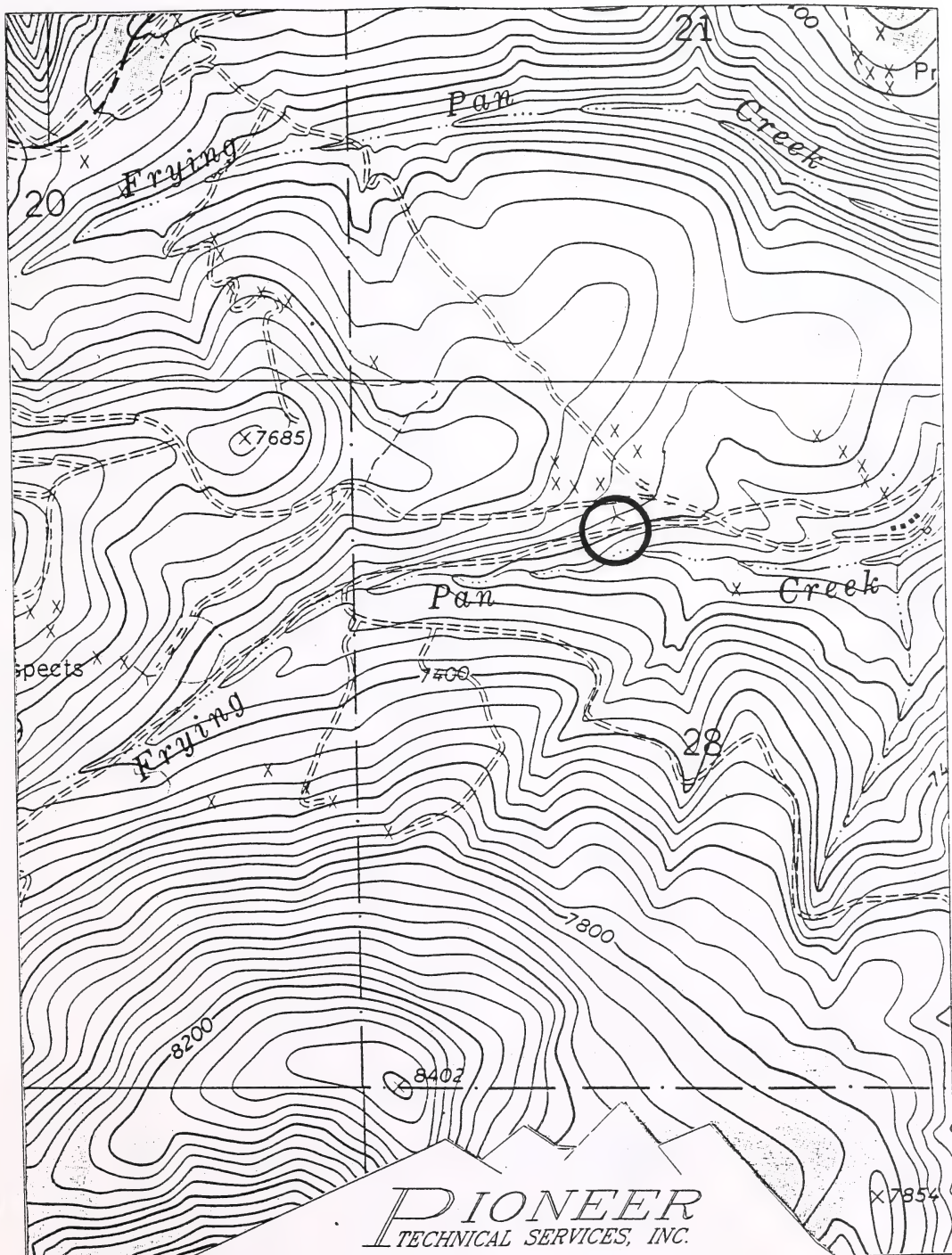
Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 1, Comment Danger signs  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes X, No     , #     , Comment Trenches

Mill Operation? Yes     , No X. If yes answer the next three  
questions:

Period(s) of Operation: N/A

Origin of Ore Milled - Custom Mill      Dedicated Mill     ; Number and  
names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
N/A

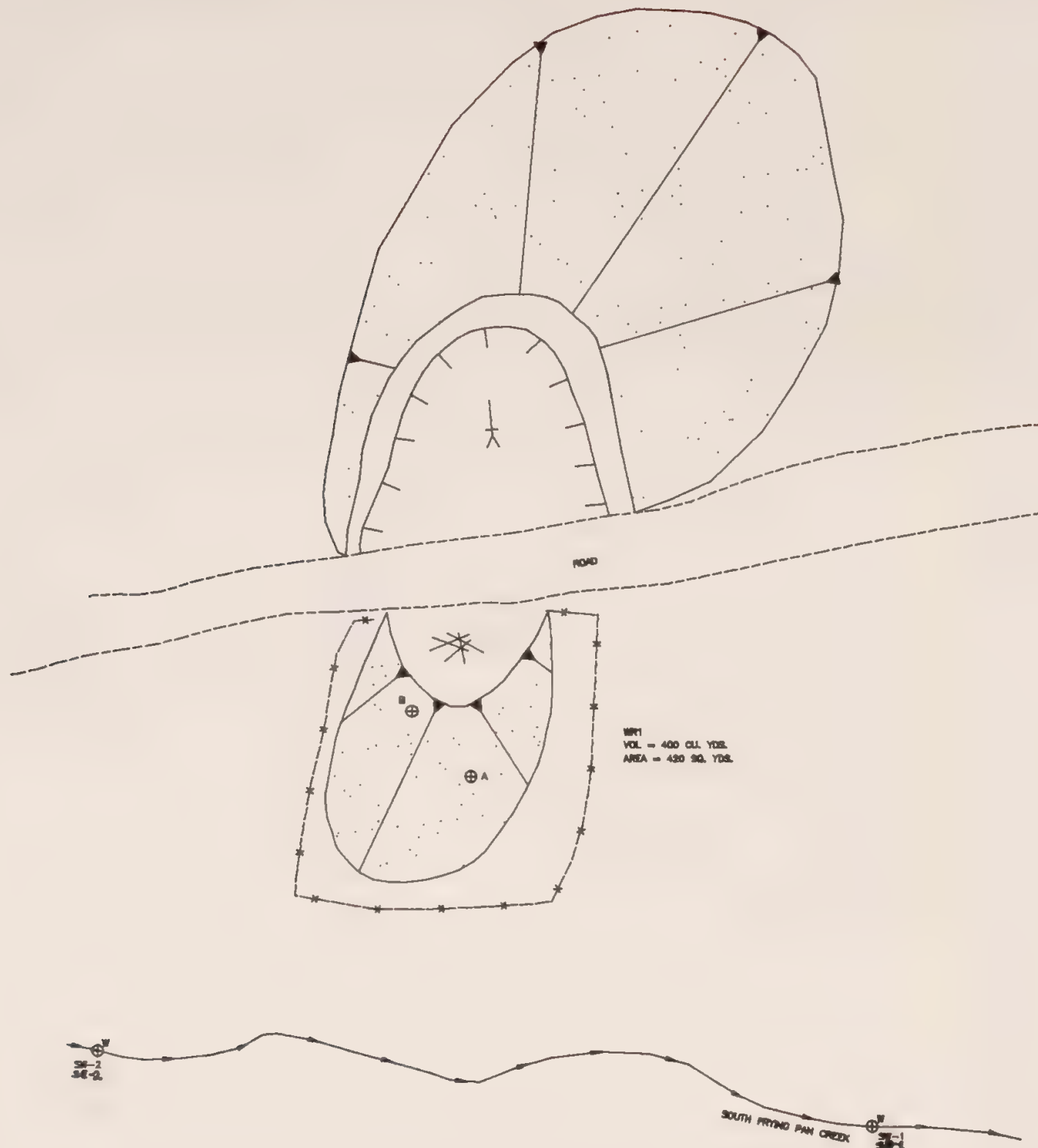


SOUTH FRYING PAN, P.A. NO. 01-211

T10S, R15W, SECTION 28

SCALE: 1" = 1000'





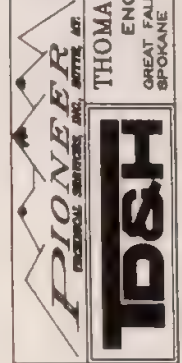
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CULVERT	⊗	OPEN ADT
✱	LIGHT (LIGHT POLE)	⊗	COLLAPSED ADT
⊙	UTILITY POLE	⊗	OPEN SHAFT
●	DECIDUOUS TREE	⊗	COLLAPSED SHAFT
⊙	CONIFEROUS TREE	⊗	EXCAVATION
— — —	WOOD FENCE	⊗	WASTE ROCK DUMP
— — —	WIRE FENCE	⊗	COLLAPSED TIMBERS
▨	BUILDING	⊗	RAILS
○	BARRIER POST	⊗	SOIL SAMPLE
∧	GATE	⊗	WATER SAMPLE
- - -	EDGE OF ASPHALT	⊗	WATER SAMPLE GROUND AND SURFACE
- - -	EDGE OF GRAVEL	⊗	DRAINAGE
▲	SLOPE DIRECTION	⊗	WATER WELL
⬢	TAILINGS POND	⊗	PONDED WATER
		⊗	VEGETATED WET LANDS



MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

SOUTH FRYING PAN CREEK MINE PA# 01-211  
LEMHI PASS DISTRICT BEAVERHEAD COUNTY

DRAWN: CAJ DATE: 11/30/93  
DESIGNED: TPR JOB NO.: 93-17  
APPROVED: WJB F.B. NO.:  
THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
SPokane MONTANA WASHINGTON







## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A



**SAMPLERS:** Bullock

\*D-Direct reading(Kelway Meter); S-Saturated Paste(Orion Meter)

Comments or deviations from SOPs:

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes     , No X, Number:      Identification:                     

Filled shafts: Yes     , No X, Number:      Identification:                     

Seeps/Springs: Yes     , No X, Number:      Identification:                     

Groundwater wells within 4 miles?: Yes X, No     ;

Number of well logs: 1

Distance to nearest well used for drinking? Possibly Selway Ranch  
located 3.25 miles from site.

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite     , Probable     , Possible X, Unlikely     .

Dump in floodplain; shallow groundwater; elevated metal values.

Other observations/notes: N/A

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):



### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No    , Name(s): South Frying Pan Creek

Dry streambeds: Yes    , No X, Name(s):                     

Other surface water: Yes    , No X, Name(s)/Description:                     

Waste materials within any floodplain: Yes X, No     Source ID(s): Toe of WR-1 is in South Frying Pan Creek floodplain.

Approximate Flood frequency?     1 yr, X 10 yr,     100 yr

Estimated seasonal flow of stream(s) (cfs)? 0.5 during investigation  
High Flow: 2 cfs, Average Flow: 0.5 cfs

Distance between waste source(s) and nearest surface water body (ft)? 35 feet

Surface water draining onto or through waste sources: Yes    , No X,  
Describe:                     

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Stock watering, irrigation, fishery

Observed erosional/sedimentation/stream turbidity problems? Yes    ,  
No X, Distance downstream (ft)?                      Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): None observed during this investigation.



**SAMPLERS:** Tuesday

**FLOW: Estimated (E) or Measured (M)?**

 Comments or Deviations from the SOPs (Pioneer SAP, 1993): | NM = Not Measured |

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? 2 to 3 acres

Wetlands present: Yes X, No    , Describe: Minor wetlands in stream bottom.

Carbonate rocks/soils: Yes    , No X, Describe:                     

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 X; 10-30    ; 30-100    ; 100-300    ; 300-1,000    ; 1,000-3,000    ; 3,000-10,000    ; 10,000 or greater    ; Comments                     

Nearest residence(ft or miles)? 3.25 miles to Selway Ranch (not sure if it is a residence).

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
            observed              high              moderate              low              none

SAMPLERS: Bullock

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X, Describe: \_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_; 300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_; Comments None

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: Litter; foot prints

Accessibility - Fences, warning signs, closed roads? Adjacent to road; fenced with stock fence; one sign

Sensitive environments on-site or adjacent to site:

State or National Parks - Yes\_\_\_\_, No X, Comment\_\_\_\_\_  
Wilderness Area - Yes\_\_\_\_, No X, Comment\_\_\_\_\_  
T&E Species Habitat - Yes\_\_\_\_, No X, Comment\_\_\_\_\_  
Bat Habitat - Yes\_\_\_\_, No X, Comment\_\_\_\_\_

Primary Drainage\_\_\_\_; Secondary Drainage\_\_\_\_; No Information X:

Riparian Habitat Quality - High\_\_\_\_, Medium\_\_\_\_, Low\_\_\_\_  
Wetlands Frontage - High\_\_\_\_, Medium\_\_\_\_, Low\_\_\_\_  
Fisheries Habitat and Species Classification - \_\_\_\_  
Sport Fishery Classification - \_\_\_\_

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Hazardous structures: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes X, No\_\_\_\_, Number 1, types and locations: WR-1 is supported with wood cribbing and is steep and unstable.  
\_\_\_\_\_  
\_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain:\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## **Bibliography**

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for South Frying Pan, Prepared by Chen-Northern, July 12, 1989.

USGS, Topographic Map, Lemhi Pass, Montana, 7 1/2 minute Quadrangle, 1988.





LABORATORY ANALYTICAL DATA

SOUTH FRYING PAN CREEK  
PA NO. 01-211



## SOLID MATRIX ANALYSES

### Metals in soils

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
01-211-SE-1	9.79 U	234 J	1.9 U	3.15	7.94	7.45	5530	0.057 U	84	13.6 J	13.4 U	12.9 UJ	25.4	NR
01-211-SE-2	7.01 U	63.8 J	1.3 U	2.65	6.83	2.56	5310	0.04 U	141	8.13 J	9.61 U	10.3 J	15.5	NR
01-211-WR-1	89.3	4520 J	2.5	28.2	15900	0.585 J	0.985 J	0.055 J	6620	18.3 J	1120	28.5 J	420	NR
01-211-WR-2	6.5	371 J	0.9 U	9.62	16.1	43.3	6780	0.156 J	1010	18.4 J	90.7	6.27 UJ	72.8	NR
BACKGROUND	5.13 U	221 J	1.0 U	3.82	4.61	6.23	7120	0.033 U	944	9.52 J	7.03 U	6.79 UJ	33.6	NR

## Acid/Base Accounting

FIELD ID	Analyte Th-228 ( $\mu\text{Ci/g}$ )	Analyte Th-230 ( $\mu\text{Ci/g}$ )	Analyte Th-232 ( $\mu\text{Ci/g}$ )	Analyte U-234 ( $\mu\text{Ci/g}$ )	Analyte U-235 ( $\mu\text{Ci/g}$ )	Analyte U-238 ( $\mu\text{Ci/g}$ )
01-211-WR-1*	530 [20] 27 [2]	140 [10] 2.1 [0.6]	510 [20] 20 [2]	2.1 [0.7] 1.3 [0.5]	0.0 [0.2] 0.0 [0.2]	2.3 [0.7] 1.0 [0.5]
01-211-WR-2*						
BACKGROUND*	1.6 [0.7]	1.4 [0.05]	1.7 [0.7]	0.9 [0.5]	0.0 [0.2]	0.8 [0.5]

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested; \* - From Barringer Laboratory.

[ ] - Plus or minus.

## WATER MATRIX ANALYSES

Metals in Water	Results in ug/L
Aluminum	0.0000
Barium	0.0000
Bismuth	0.0000
Boron	0.0000
Bromine	0.0000
Cadmium	0.0000
Calcium	0.0000
Chromium	0.0000
Copper	0.0000
Fluorine	0.0000
Gold	0.0000
Iron	0.0000
Lead	0.0000
Lithium	0.0000
Magnesium	0.0000
Manganese	0.0000
Mercury	0.0000
Molybdenum	0.0000
Nickel	0.0000
Phosphorus	0.0000
Potassium	0.0000
Selenium	0.0000
Silver	0.0000
Sodium	0.0000
Sulfur	0.0000
Tin	0.0000
Titanium	0.0000
Vanadium	0.0000
Zinc	0.0000

ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn
													(mg CuCO <sub>3</sub> )
01-211-SW-1	1.9	32.3	2.57 U	9.7 U	6.83 U	1.55 U	64.7	0.12 U/X	7.37	14	3.88 J	30.7 U	22.7
01-211-SW-2	0.96 U	28.9	2.57 U	9.7 U	6.83 U	1.55 U	48.5	0.15 J/X	9.2	17.6	2.26 J	30.7 U	20.9

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Reported

FIELD

ID

Analyte

U-228  
(pCi/l)

Analyte

U-230  
(pCi/l)

Analyte

Th-232  
(pCi/l)

Analyte

U-234  
(pCi/l)

Analyte

U-238  
(pCi/l)

Analyte

0.0 [1-1]

2.0 [1-5]

0.0 [1-1]

0.0 [1-1]

0.0 [0.5]

0.0 [0.5]

Analyte

0.9 [1-4]

1.8 [1-5]

0.0 [1-1]

0.0 [2-3]

0.0 [1-6]

0.0 [2.0]

01-211-SW-1\*

01-211-SW-2\*

Plots or maps

LEGEND

(1-3)

### Wet Chemistry

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3-N	NO2-N	CYANIDE
01-211-SW-1	50	< 5.0	< 5	< 0.05	NR	NR
01-211-SW-2	55	< 5.0	< 5	< 0.05	NR	NR

### LEGEND

SE1 - Downstream on South Frying Pan Creek.

SE2 - Upstream on South Frying Pan Creek.

WR1 - South of dump #1; sample of the WR1 subsample.

WR2 - Northwest side of dump #1; sample of the WR2 subsample.

BACKGROUND - From the Last Chance #1/ER (01-216-SS-1).

SW1 - Same as sample SE1.

SW2 - Same as sample SSE2.



XRF ANALYSIS RESULTS

SOUTH FRYING PAN CREEK  
PA NO. 01-211





Mine Name: South Frying Pan Creek PA# 01-211  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-211-WR1-A		15349.1	3775.16	657.076 *	253.976 *	8417.7	52543.7		552.938	587.858		363.865
01-211-WR1-B		24227.9	8389.96	3732.19		3850.5	40235.6		210.405	198.82	118.91 *	190.189
01-211-WR1-B-DUP		25307.8	8743.59	3784.96		4124.76	41115.3		217.281	228.735	142.843 *	199.61
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-211-WR1-A	166.898			403.328			91.5715 *	13863.7		150.496	1700.72	
01-211-WR1-B	302.554			101.251 *	37.6619 *			1662.97		118.81	338.828	
01-211-WR1-B-DUP	301.143			81.2705 *	41.848 *			1655.34		122.291	349.415	

\* - Estimated Quantity  
\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

SOUTH FRYING PAN CREEK  
PA NO. 01-211



# AIMSS SCORESHEET

SITE NAME: SOUTH FRYING PAN CK  
PA NUMBER: 01-211

LINE NO.		GROUNDWATER PATHWAY	
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD	CONTAINMENT	20
3B	OF RELEASE	GW DEPTH	20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
6			0.256
6		WELLS - 1 MI. x 2.5	0.0
7	GW - TARGETS	WELLS - 1 TO 4 MI	1
8		NEAREST WELL	0
9		TARGETS SCORE	LINES 6 + 7 + 8
10		GROUNDWATER SCORE	LINES 4 x 5 x 9
			102
		SURFACE WATER PATHWAY	
11		OBSERVED RELEASE	300
12	SW - LIKELIHOOD	EXCEEDENCES	0
13A	OF RELEASE	CONTAINMENT	20
13B		DISTANCE TO SW	10
13C		POTENTIAL TO RELEASE	LINES 13A x 13B
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
16			0.392
16		DRINKING WATER POP'N	0
17		IMPACTED DRAINAGE	0
18		WETLANDS	0
19	SW - TARGETS	FISHERY	0
20		RECREATION	0
21		IRRIGATION/STOCK	2
22		T & E SPECIES HABITAT	0
23		TARGETS SCORE	SUM LINES 16 - 22
24		SURFACE WATER SCORE	LINES 14 x 15 x 23
			392
		AIR PATHWAY	
25		OBSERVED RELEASE	0
26A	AIR - LIKELIHOOD	CONTAINMENT	10
26B	OF RELEASE	DISTANCE TO POPULATION	5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B
27		LIKELIHOOD SCORE	LINES 25 + 26C
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
29			0.039
29		POPULATION - 4 MILES	1
30		NEAREST RESIDENCE	0
31	AIR - TARGETS	WETLANDS	0
32		PARKS / WILDERNESS	0
33		T & E SPECIES HABITAT	0
34		TARGETS SCORE	SUM LINES 29 - 33
35		AIR PATHWAY SCORE	LINES 27 x 28 x 34
			2
		DIRECT CONTACT PATHWAY	
36		OBSERVED EXPOSURE	50
37A	LIKELIHOOD OF	ACCESSIBILITY	10
37B	EXPOSURE	DISTANCE TO POPULATION	5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B
38		LIKELIHOOD SCORE	LINES 36 + 37C
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
40	DIRECT CONTACT	POPULATION - 1 MILE	0
41	TARGETS	NEAREST RESIDENCE	0
42		RECREATIONAL USE	5
43		TARGETS SCORE	SUM LINES 40 - 42
44		DIRECT CONTACT SCORE	LINES 38 x 39 x 43
			13
45	TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE		
	(LINES 10 + 24 + 35 + 44) / 100,000		0.01

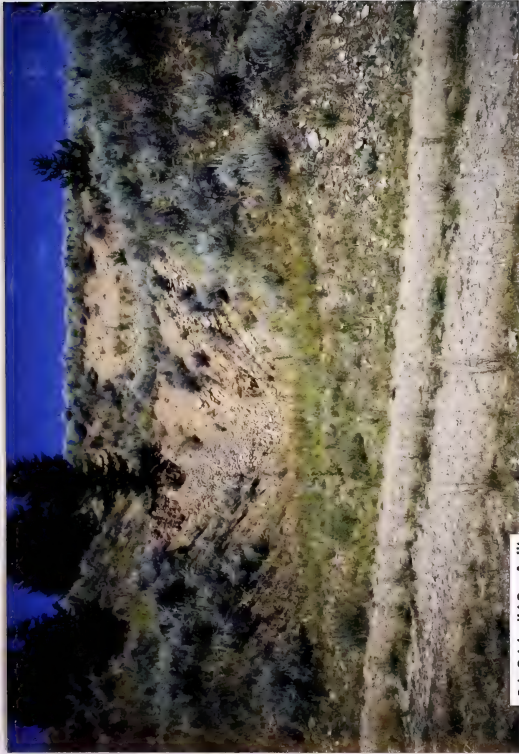
SITE NAME: SOUTH FRYING PAN CK  
 PA NUMBER: 01-211

LINE  
NO.

**SITE SAFETY**

1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	0
9		POPULATION - 1 MILE		0
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		5
12		TARGETS SCORE	SUM LINES 9 - 11	5
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>0.00</b>





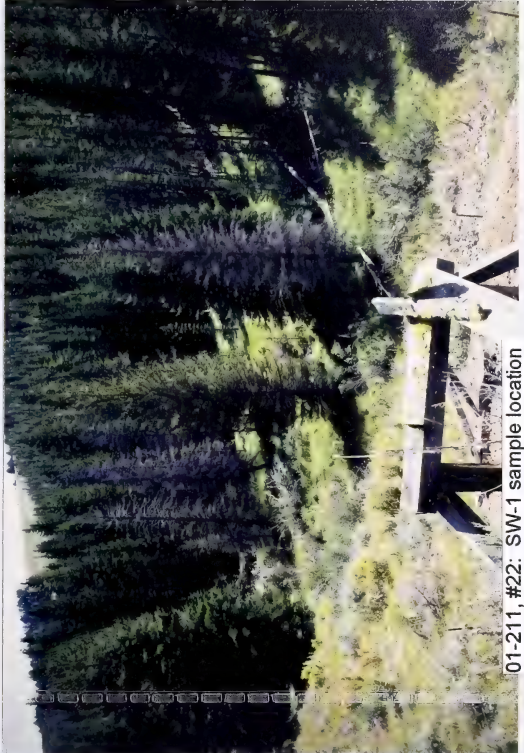
01-211, #19: Adit



01-211, #20: SW-2 sample location



01-211, #21: WR-1, facing west



01-211, #22: SW-1 sample location



MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: LAST CHANCE NO. 1/IER PA#: 01-216

Date: August 25, 1993 Time: 0900-1030

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Tuesday, Pioneer

Visitors: Tim Pfahler, MDSL Helicopter Pilot

Weather/Seasonality Observations: Clear; calm; 34°F.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #12: Adit; #13: WR-1, looking west; #14: WR-1, looking north; #16: Exploration trench.  
Video Tape No. 5

General Comments/Observations (not covered specifically in attached Inventory Forms): High radiation readings in open trench above the adit. Barrels reported to be present during the 1989 site visit have been removed.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Backfill trench; grade and cover dump for shielding.





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): LAST CHANCE NO. 1/IER PA#: 01-216

Legal Description: T 10S ; R 15W ; Sec. 29 , NE1/4 NW1/4 1/4

County: BEAVERHEAD Mining District: LEMHI PASS

Latitude: N 44° 56' 25" Longitude: W 113° 28' 12"

Primary Drainage Basin and Code: North Frying Pan Creek/10020001

Secondary Drainage Basin: North Frying Pan Creek

USGS Quadrangle map name(s): Lemhi Pass

Mine Type/Commodities: Hardrock/Thorium, Uranium

Activity Status: Active      , Inactive/Exploration X , Abandoned      .

Ownership status: Known YX N ; private/public? Public

Owner, Agent, or Contact (Include address and phone when available): Beaverhead National Forest.

Relationship to other mines/sites in the area/district: Within the same deposit as the Last Chance No. 2 and the South Frying Pan Creek mines.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? Road to mine has been closed and recently reseeded.

General site features: Elevation 7600' , Slope 10°-25° ,  
Aspect Northern

Land use: Mining X , Recreational X , Residential      , Urban      ,  
Agricultural      , Other (Specify)     

Area of disturbed/unvegetated lands? 0.5 acres.  
Dimensions: 140 feet x 135 feet

Predominant vegetation types: Lodgepole pine, grouse whortleberry

Access: roads - good      , poor X , 4wd      , trail      .  
Other logistical considerations (proximity to other sites). On the same road as Last Chance No.2 and South Frying Creek mines. Road closure approximately 1/2 mile prior to the site.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Site lies near top of ridge above North  
Frying Pan Creek. A dry gulch draining into the intermittent North  
Fork drains to the southeast away from the site. The site is  
underlain by intrusive. High radiation readings on-site; readings  
ranged from 0.9 to 7.0 mR/HR.

Mining/milling history, ore type/tenor, host rock, gangue: No  
information available.

Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 1, Comment       
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes X, No     , # 2, Comment Open trenches cut uphill  
from adit

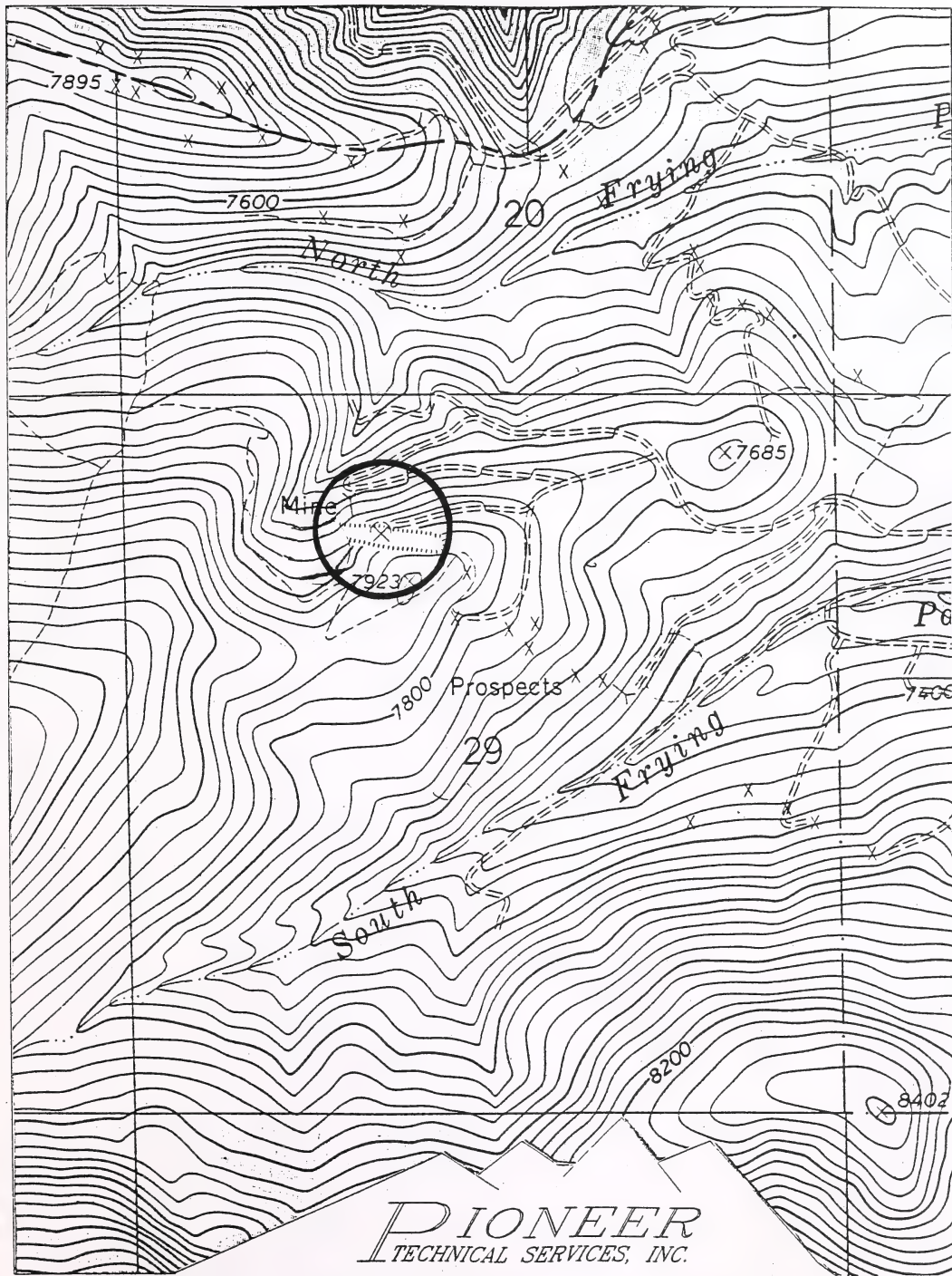
Mill Operation? Yes     , No X. If yes answer the next three  
questions:

Period(s) of Operation: N/A

Origin of Ore Milled - Custom Mill      Dedicated Mill     ; Number and  
names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN<sup>-</sup> leach (vat, heap), floatation, smelting?  
N/A





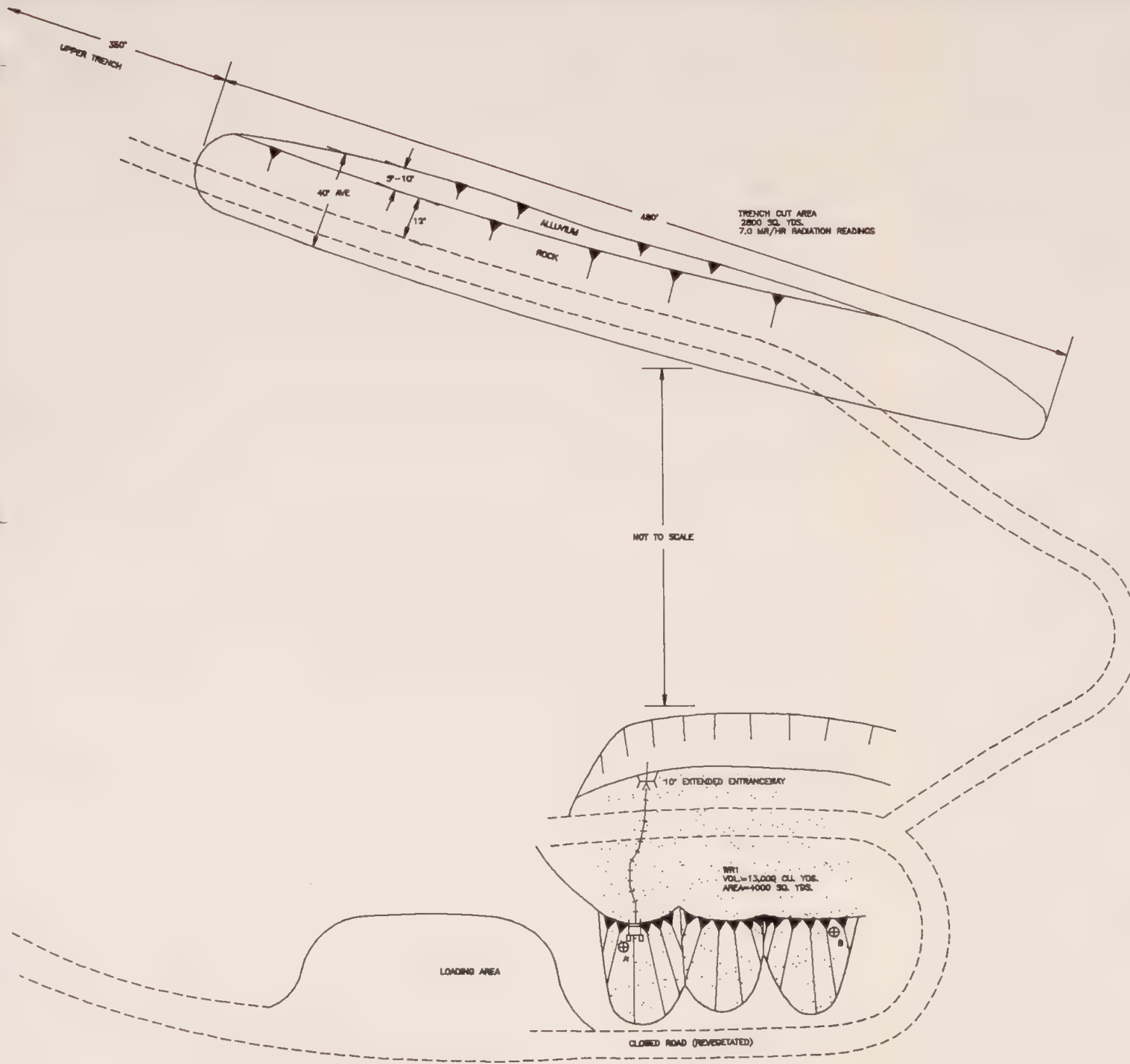
*PIONEER*  
TECHNICAL SERVICES, INC.

LAST CHANCE #1, P.A. NO. 01-216

T10S, R15W, SECTION 29

SCALE: 1" = 1000'





EXISTING	DESCRIPTION	EXISTING	DESCRIPTION
	CULVERT		OPEN ADIT
	LIGHT (LIGHT POLE)		COLLAPSED ADIT
	UTILITY POLE		OPEN SHAFT
	CENTERLINE MONUMENT		COLLAPSED SHAFT
	DECIDUOUS TREE		EXCAVATION
	CONIFEROUS TREE		WASTE ROCK DUMP
	WOOD FENCE		COLLAPSED TIMBERS
	WIRE FENCE		RAILS
	BUILDING		SOIL SAMPLE
	BARRIER POST		XRF SAMPLE
	GATE		WATER SAMPLE
	EDGE OF ASPHALT		GROUND AND SURFACE
	EDGE OF GRAVEL		DRAINAGE
	SLOPE DIRECTION		WATER WELL



MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

LAST CHANCE #1 PA# 01-216  
LEMHI PASS DISTRICT BEAVERHEAD COUNTY

SHEET NO.

PIONEER  
ENGINEERING CONSULTANTS

TDS&H

DRAWN: JTP DATE: 1 OCT 93  
DESIGNED: JTP JOB NO: 93-17  
APPROVED: JUB F.B. NO.

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A





**SAMPLERS:** Tuesday

[illegible]

D-Diastereotopic reading (Kelway Meter); B-Saturated Paste (Orion Meter)

Comments or deviations from SOPs: 01-216-WR-1 is composite of WR-1A and -1B. Highest radioactive measurement from trench uphill from adit reading 7.0 mR/HR. NM = Not Measured

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes ☐, No ☒, Number:  Identification:

Filled shafts: Yes ☐, No ☒, Number:  Identification:

Seeps/Springs: Yes ☐, No ☒, Number:  Identification:

Groundwater wells within 4 miles?: Yes ☐, No ☒;

Number of well logs:  0

Distance to nearest well used for drinking? Sacajewa Memorial Camp is 3 miles away; may have a well. Nearest residence with possible well is 1.5 miles away. No well logs for either.

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite ☐, Probable ☐, Possible ☒, Unlikely ☐.

No discharge from adit; no evidence of past discharge. Metal values in dump are low except Thorium and Uranium.

Other observations/notes: N/A

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

## C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes     , No X, Name(s):                     

Dry streambeds: Yes X, No     , Name(s): Small intermittent drainage approx. 250 feet from toe of dump; drainage joins with the North Fork of Frying Pan Creek (intermittent stream) in approx. 1/4 mile.

Other surface water: Yes     , No X, Name(s)/Description:                     

Waste materials within any floodplain: Yes     , No X Source ID(s):     

Approximate Flood frequency?      1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)? N/A

High Flow:                     , Average Flow:                     

Distance between waste source(s) and nearest surface water body (ft)? 250 feet to small drainage; 1/4 mile to North Fork Frying Pan Creek; no evidence of erosion from waste rock dump.

Surface water draining onto or through waste sources: Yes     , No X, Describe:                     

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?) Irrigation, stock watering, possible fishery

Observed erosional/sedimentation/stream turbidity problems? Yes     , No X, Distance downstream (ft)?                      Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):



### SAMPLERS:

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

## 11

+

t



## ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

**SAMPLERS:** Bullock, Tuesday

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe: \_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments None

Evidence of recreational use on site: Yes\_\_\_\_, No X, Describe: \_\_\_\_\_

Accessibility - Fences, warning signs, closed roads? Road closed  
approx. 1/2 mile from site; radiation signs posted.

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment_____
Wilderness Area -	Yes____, No <u>X</u> , Comment_____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment_____
Bat Habitat -	Yes____, No <u>X</u> , Comment_____

Primary Drainage\_\_\_\_; Secondary Drainage\_\_\_\_; No Information X:

Riparian Habitat Quality - High\_\_\_\_, Medium\_\_\_\_, Low\_\_\_\_  
Wetlands Frontage - High\_\_\_\_, Medium\_\_\_\_, Low\_\_\_\_  
Fisheries Habitat and Species Classification - \_\_\_\_\_  
Sport Fishery Classification - \_\_\_\_\_

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No\_\_\_\_, Number 1, types and locations:\_\_\_\_  
Adit is currently gated and locked.

Hazardous structures: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes X, No\_\_\_\_, Number 1,  
types and locations: Associated with the trench cut above the adit

Unstable waste piles, impoundments, undercut banks: Yes X, No\_\_\_\_,  
Number 1, types and locations: Waste rock dump at angle of repose.

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain: \_\_\_\_\_

XRF ANALYSIS RESULTS

LAST CHANCE NO. 1  
PA NO. 01-216

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Mine Name: Last Chance #1/IER PA# 01-216

XRF Field Analyses

Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-216-WR1-A	618.227 *	10574.1	3443.7	406.398 *	399.074 *	767.261 *	33226.5		281.717	139.519	201.274	229.709
01-216-WR1-B					260.725 *							
01-216-WR-1-COMP	541.126 *				400.792 *							
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-216-WR1-A												
01-216-WR1-B	125.024						178.502	12460		66.6947	1067.38	
01-216-WR-1-COMP												

\* - Estimated Quantity

\$ - Unvalidated Data

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## **Bibliography**

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Last Chance No. 1, Prepared by Chen-Northern, July 12, 1989.

USGS, Topographic Map, Lemhi Pass, Montana, 7 1/2 minute Quadrangle, 1988.



LABORATORY ANALYTICAL DATA

LAST CHANCE NO. 1  
PA NO. 01-216



# SOLID MATRIX ANALYSES

## Metals in soils Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
01-216-WR-1	37.4	4370 J	0.8 U	18.8	2.63	70.6	9120	4.53 J	4760	13 J	31.1	11.8 J	149	NR
BACKGROUND	5.13 U	221 J	1.0 U	3.82	4.61	6.23	7120	0.033 U	944	9.52 J	7.03 U	6.79 UJ	33.6	NR

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Requested \* - From Barringer Laboratory

## Radiochemistry

FIELD ID	Analyte Th-230 (pCi/l)	Analyte Th-232 (pCi/l)	Analyte U-234 (pCi/l)	Analyte U-235 (pCi/l)	Analyte U-238 (pCi/l)
01-216-WR-1*	440 [20]	150 [10]	420 [20]	6.8 [1.1]	0.1 [0.3]
BACKGROUND*	1.6 [0.7]	1.4 [0.05]	1.7 [0.7]	0.9 [0.5]	0.0 [0.2]

[ ] - Plus or minus.

## Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE POTENTIAL U/1000t	NEUTRAL POTENTIAL U/1000t	SULFUR ACID BASE POTENTIAL U/1000t	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE POTENTIAL U/1000t	SULFUR ACID BASE POTENTIAL U/1000t
01-216-WR-1	0.49	15.3	20.1	4.8	0.03	0.04	0.42	1.25	18.9

## LEGEND

WR1 - Composite of subsamples WRI A and 1B.  
BACKGROUND - From the Last Chance #1/IER (01-216-SS-1).





Mine Name: Last Chance #1/IER PA# 01-216  
 XRF Field Analyses  
 Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-216-WR1-A	618.227 *	10574.1	3443.7	406.398 *	399.074 *	767.261 *	33226.5		281.717	139.519	201.274	239.709
01-216-WR1-B					260.725 *							
01-216-WR-1-COMP	541.126 *				400.792 *							
01-216-WR1-A	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-216-WR1-B	125.024						178.502	12460		66.6947	1067.38	
01-216-WR-1-COMP												

\* - Estimated Quantity  
 \$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

LAST CHANCE NO. 1  
PA NO. 01-216



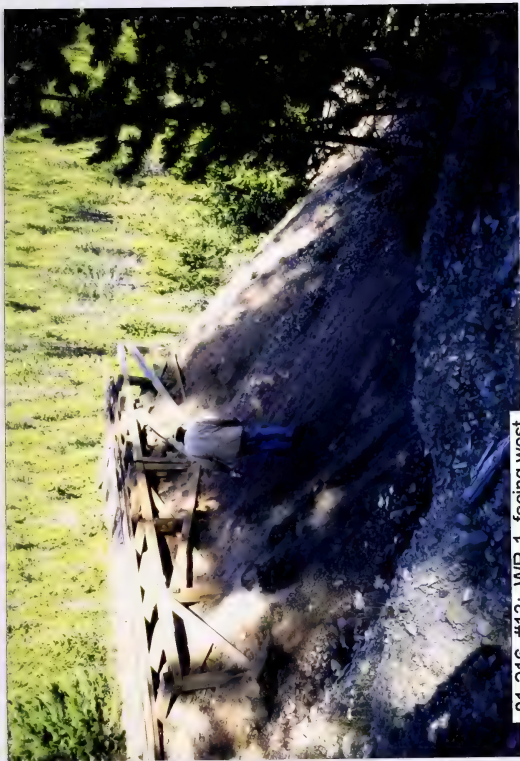
# **AIMSS SCORESHEET**

SITE NAME: \_\_\_\_\_  
PA NUMBER: \_\_\_\_\_ LAST CHANCE # 1/IER 01-216

LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	10.912
6		WELLS - 1 MI. x 2.5		0.0
7	GW - TARGETS	WELLS - 1 TO 4 MI		0
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	0.0
10		<b>GROUNDWATER SCORE</b>	LINES 4 x 5 x 9	0
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		0
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		2
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	40
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	40
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	21.189
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18	SW - TARGETS	WETLANDS		0
19		FISHERY		0
20		RECREATION		0
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	2
24		<b>SURFACE WATER SCORE</b>	LINES 14 x 15 x 23	1695
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.212
29		POPULATION - 4 MILES		10
30	AIR - TARGETS	NEAREST RESIDENCE		0
31		WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	10
35		<b>AIR PATHWAY SCORE</b>	LINES 27 x 28 x 34	106
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		0
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		5
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	25
38		LIKELIHOOD SCORE	LINES 36 + 37C	25
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.109
40	DIRECT CONTACT	POPULATION - 1 MILE		0
41	TARGETS	NEAREST RESIDENCE		0
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 - 42	0
44		<b>DIRECT CONTACT SCORE</b>	LINES 38 x 39 x 43	0
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			0.02
	(LINES 10 + 24 + 35 + 44) / 100,000			

LINE NO.	SITE SAFETY		
1	THREAT	ACCESSIBILITY	5
2		OPEN SHAFTS 100 EA.	0
3		OPEN ADITS 50 EA.	50
4	HAZARDS	UNSTAB. HIWALLS / PITS 75 EA.	0
5		HAZ. STRUCTURES 40 EA.	0
6		EXPLOSIVES	0
7		HAZ. MATERIALS	0
8		HAZARDS SCORE SUM LINES 2 - 7	50
9		POPULATION - 1 MILE	0
10	TARGETS	NEAREST RESIDENCE	0
11		RECREATIONAL USE	0
12		TARGETS SCORE SUM LINES 9 - 11	0
13		SITE SAFETY SCORE (LINES 1 x 8 x 12) / 1,000	0.00

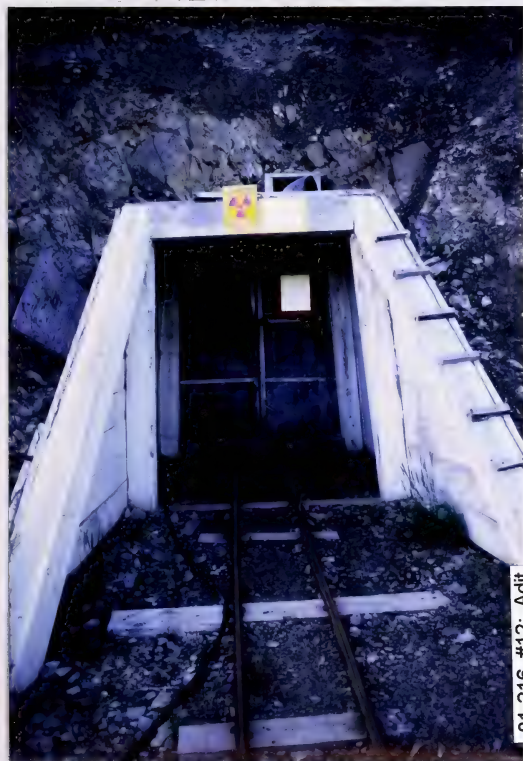




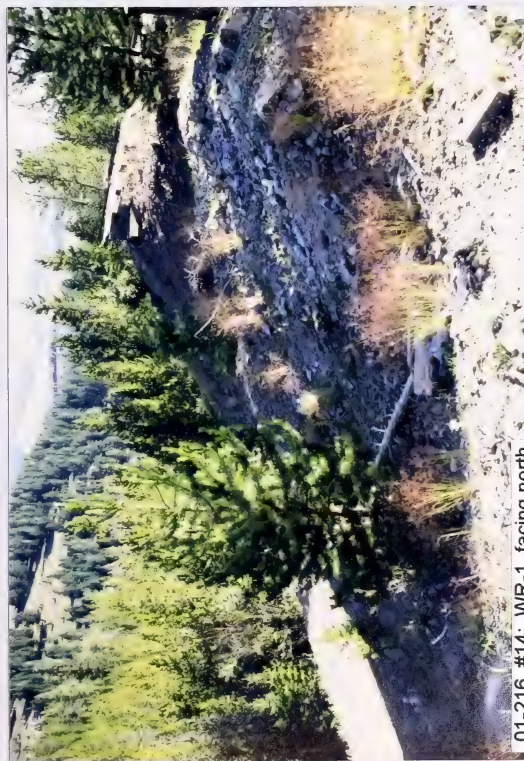
01-216, #13: WR-1, facing west



01-216, #16: Exploration trench above mine



01-216, #12: Adit



01-216, #14: WR-1, facing north



MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: LAST CHANCE NO. 2/IER PA#: 01-220

Date: August 25, 1993 Time: 1045

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Tuesday, Pioneer

Visitors: Tim Pfahler, MDSL Helicopter Pilot

Weather/Seasonality Observations: Sunny; cool.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #17: WR-1A; #18:  
Highwall and top of dump. Video Tape No. 5

General Comments/Observations (not covered specifically in attached Inventory Forms): Partially reclaimed

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Cover  
radioactive material and revegetate.





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): LAST CHANCE NO. 2/IER PA#: 01-220

Legal Description: T 10S ; R 15W ; Sec. 29 , SW 1/4 NE 1/4 1/4

County: BEAVERHEAD Mining District: LEMHI PASS

Latitude: N 45° 56' 08" Longitude: W 113° 27' 48"

Primary Drainage Basin and Code: Frying Pan Creek/10020001

Secondary Drainage Basin: South Frying Pan Creek

USGS Quadrangle map name(s): Lemhi Pass

Mine Type/Commodities: Hardrock/Thorium, rare earths

Activity Status: Active     , Inactive/Exploration X , Abandoned     .

Ownership status: Known YX N ; private/public? Public  
Owner, Agent, or Contact (Include address and phone when available): Beaverhead National Forest.

Relationship to other mines/sites in the area/district: Last Chance No. 1 site is located 1/4 mile northwest and over ridge; South Frying Pan Creek site is located 3/4 mile east and downstream.

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Adit and top of dump have been partially reclaimed possibly by USFS.

General site features: Elevation 7480' , Slope 20° , Aspect Southeast

Land use: Mining X , Recreational X , Residential     , Urban     , Agricultural     , Other (Specify)    

Area of disturbed/unvegetated lands? 0.5 acres.  
Dimensions: 140 feet x 155 feet

Predominant vegetation types: Douglas fir, Lodgepole pine, sage brush, blue bunch wheat grass

Access: roads - good     , poor X , 4wd     , trail     .  
Other logistical considerations (proximity to other sites). Locked gate on road at Forest Service boundary.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Site lies above and on the northwest side  
of South Frying Pan Creek. Water leaving the site would flow  
southeast to creek and then northeast away from the site in South  
Frying Pan Creek. North and South Frying Pan Creek meet to form  
Frying Pan Creek approx. 1.5 miles downgradient of the site.

Mining/milling history, ore type/tenor, host rock, gangue: No  
information available.

Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 1, Comment Reclaimed/covered  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

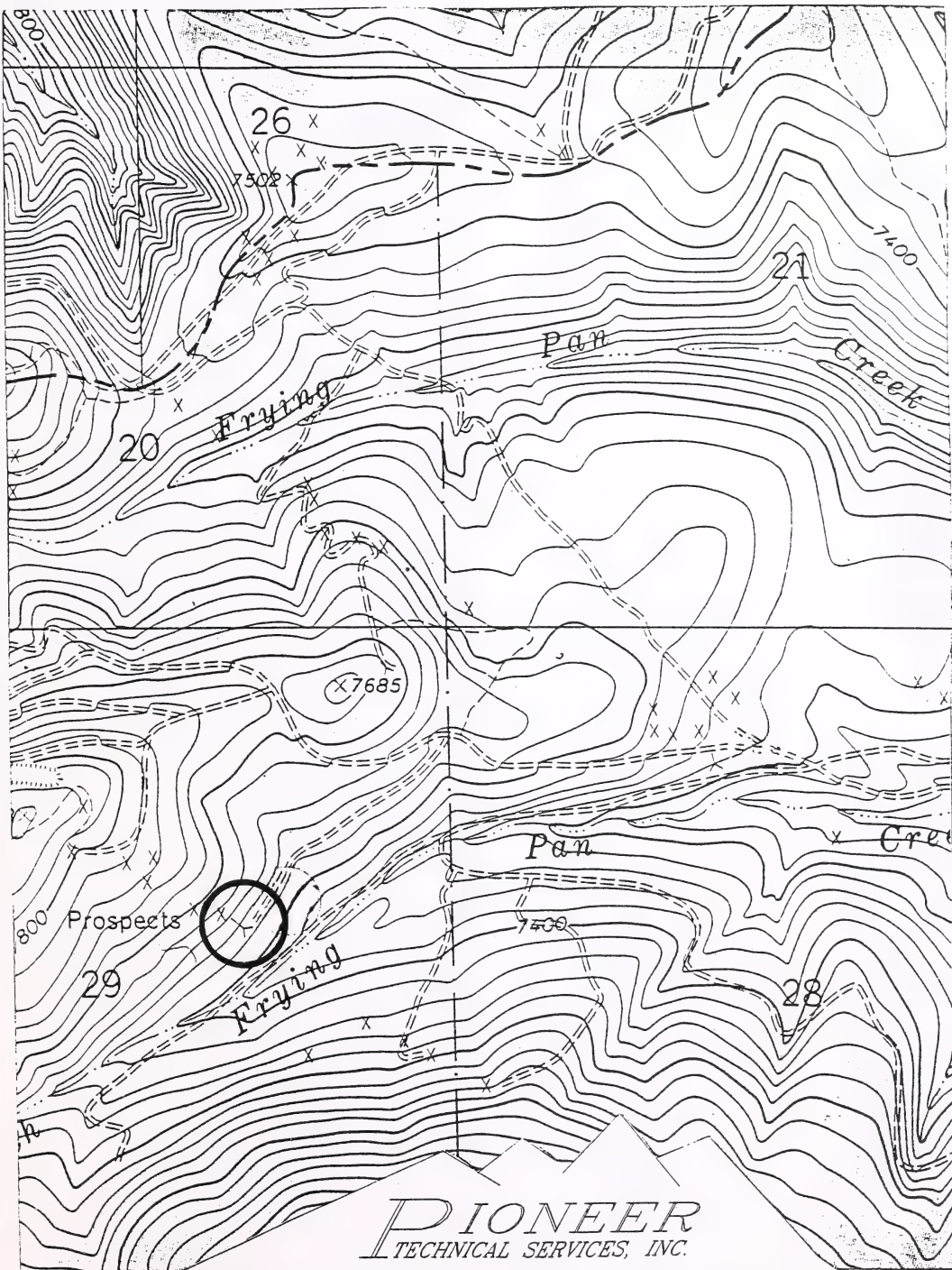
Mill Operation? Yes     , No X. If yes answer the next three  
questions:

Period(s) of Operation: N/A

Origin of Ore Milled - Custom Mill      Dedicated Mill     ; Number and  
names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
N/A





**PIONEER**  
TECHNICAL SERVICES, INC.

LAST CHANCE #2, P.A. NO. 01-220

T10S, R15W, SECTION 29

SCALE: 1" = 1000'



MINOR TRENCHING AND  
EXPLORATION WORK  
ON HILLSIDE ABOVE

TO SOUTH FRYING PAN CREEK MINE

BURNED  
ADIT  
LOCATION

WM  
VOL = 11000 CU. YDS.  
AREA = 2300 SQ. YDS.

NOT TO SCALE

# LEGEND

SYMBOL	DESCRIPTION
=====	CULVERT
*	LIGHT (LIGHT POLE)
⊙	UTILITY POLE
●	DECIDUOUS TREE
⊕	CONIFEROUS TREE
— — —	WOOD FENCE
— — —	WIRE FENCE
▨	BUILDING
○	BARBER POST
∧	GATE
- - -	EDGE OF ASPHALT
- - -	EDGE OF GRAVEL
▲	SLOPE DIRECTION
○	TAILINGS POND

SYMBOL	DESCRIPTION
— — —	OPEN ADIT
— — —	COLLAPSED ADIT
— — —	OPEN SHAFT
— — —	COLLAPSED SHAFT
○	EXCAVATION
○	WASTE ROCK DUMP
▨	COLLAPSED TIMBERS
— — —	RAILS
⊙	SOIL SAMPLE
⊕	XRF SAMPLE
⊕	WATER SAMPLE
⊕	GROUND AND SURFACE
⊕	CRASHAGE
●	WATER WELL
— — —	PONDED WATER
— — —	VEGETATED WET LANDS

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

LAST CHANCE #2 PA# 01-220  
LEMHI DISTRICT BEAVERHEAD COUNTY

PIONEER  
ENGINEERING

TDSH

DRAWN: CAI DATE: 12/8/93  
DESIGNED: TFR JOB NO.: 93-17  
APPROVED: MJB F.S. NO.:

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
SPOKANE MONTANA WASHINGTON

01-220.DWGSHEETS

SHEET NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A





SAMPLERS: Bullock

[illegible]

D-Direct reading(Kelvin Meter); S-Saturated Paste(Orion Meter)

**Comments or deviations from SOPs:** 01-220-WR-1 is composite of WR-1A through -1C.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes     , No X, Number:      Identification:                     

Filled shafts: Yes     , No X, Number:      Identification:                     

Seeps/Springs: Yes     , No X, Number:      Identification:                     

Groundwater wells within 4 miles?: Yes     , No X;

Number of well logs: 0

Distance to nearest well used for drinking? Possibly at the Selway Ranch 5 miles from the site.

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite     , Probable     , Possible     , Unlikely X.

Low metals; far from water; dry area

Other observations/notes: N/A

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No   , Name(s): South Frying Pan Creek

Dry streambeds: Yes   , No X, Name(s):   

Other surface water: Yes   , No X, Name(s)/Description:   

Waste materials within any floodplain: Yes   , No X Source ID(s):   

Approximate Flood frequency?    1 yr,    10 yr,    100 yr

Estimated seasonal flow of stream(s) (cfs)? N/A

High Flow:   , Average Flow:   

Distance between waste source(s) and nearest surface water body (ft)? 80 to 100 feet

Surface water draining onto or through waste sources: Yes   , No X, Describe:   

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Irrigation, agriculture, possible fishery

Observed erosional/sedimentation/stream turbidity problems? Yes   , No X, Distance downstream (ft)?    Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):     
None observed during investigation.



## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

## (

### AMD Characteristics:

 $(\text{SO}_3)$ 

(ESD)

(SPG)

Presence of long filamentous algae in drainages, mosses in moist areas?

( FEOX )

( VEG )

(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? 1 to 2 acres of moderately sloping forested land

Wetlands present: Yes , No X , Describe:

Carbonate rocks/soils: Yes , No X , Describe:

### E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10\_\_\_; 10-30\_\_\_; 30-100\_\_\_;  
100-300\_\_\_; 300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or  
greater\_\_\_; Comments None

Nearest residence(ft or miles)? Approx. 5 miles

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



**SAMPLERS:** Bullock

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes ☐, No ☒, Describe: \_\_\_\_\_

Population within 1 mile: 1-10 ☐; 10-30 ☐; 30-100 ☐; 100-300 ☐; 300-1,000 ☐; 1,000-3,000 ☐; 3,000-10,000 ☐; 10,000 or greater ☐; Comments None

Evidence of recreational use on site: Yes ☐, No ☒, Describe: \_\_\_\_\_

Accessibility - Fences, warning signs, closed roads? Road closed by Forest Service 1/4 mile from site.

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes <input type="checkbox"/> , No <input checked="" type="checkbox"/> , Comment _____
Wilderness Area -	Yes <input type="checkbox"/> , No <input checked="" type="checkbox"/> , Comment _____
T&E Species Habitat -	Yes <input type="checkbox"/> , No <input checked="" type="checkbox"/> , Comment _____
Bat Habitat -	Yes <input type="checkbox"/> , No <input checked="" type="checkbox"/> , Comment _____

Primary Drainage ☐; Secondary Drainage ☐; No Information ☒:

Riparian Habitat Quality - High ☐, Medium ☐, Low ☐  
Wetlands Frontage - High ☐, Medium ☐, Low ☐  
Fisheries Habitat and Species Classification - ☐  
Sport Fishery Classification - ☐

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes ☐, No ☒, Number 1, types and locations: \_\_\_\_\_

Hazardous structures: Yes ☒, No ☐, Number 1, types and locations: Old shack on top of dump.

Unstable highwalls, pits, trenches, slopes: Yes ☐, No ☒, Number 1, types and locations: \_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes ☐, No ☒, Number 1, types and locations: \_\_\_\_\_

Fire and/or Explosion hazards: Yes ☐, No ☒, Explain: \_\_\_\_\_

## **Bibliography**

MBMG, Last Chance, Beaverhead County, Form 39, 1966-1980.

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Last Chance No. 2, Prepared by Chen-Northern, July 12, 1989.

USGS, Topographic Map, Lemhi Pass, Montana, 7 1/2 minute Quadrangle, 1965.



LABORATORY ANALYTICAL DATA

LAST CHANCE NO. 2  
PA NO. 01-220





# SOLID MATRIX ANALYSES

## Metals in soils Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
01-220-WR-1	82.1	429 J	0.8 U	8.15	8.38	84.1	13400	0.104 J	200	12.6 J	22.5	21.5 J	19.2	NR
BACKGROUND	5.13 U	221 J	1.0 U	3.82	4.61	6.23	7120	0.033 U	944	9.52 J	7.03 U	6.79 UJ	33.6	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested; \* - From Barringer Lab.

## Radiochemistry

FIELD ID	Analyte Th-230 (pCi/l)	Analyte Th-232 (pCi/l)	Analyte U-233 (pCi/l)	Analyte U-238 (pCi/l)
01-220-WR-1*	61 [6]	5 [1.8]	66 [6]	4.4 [0.9]
BACKGROUND*	1.6 [0.7]	1.4 [0.05]	0.0 [0.2]	0.8 [0.5]

[ ] - Plus or minus

## Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	NEUTRAL POTENT u/1000t	SULFUR ACID BASE POTENT u/1000t	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR u/1000t	SULFUR ACID BASE POTENT u/1000t
01-220-WR-1	0.01	0.31	13.8	13.5	0.01	<0.01	0	13.8

## LEGEND

WR1 - Composite of subsamples WR1A through 1C.  
BACKGROUND - From the Last Chance #1/IER (01-216-SS-1).



XRF ANALYSIS RESULTS

LAST CHANCE NO. 2  
PA NO. 01-220



Mine Name: Last Chance #2/IER PA# 01-220

XRF Field Analyses

Results in PPM

XRF SAMPLE ID	CrHI	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-220-WR1-B		13732.9	2909.91	1425.66		257.174 *	19403.8		44.9556 *	44.1548 *		70.4621
01-220-WR1-C		21244.5	2620.7	997.694		620.952 *	43213.9	315.107 *	208.779	42.433 *	432.658	125.879
01-220-WR-1-COMP		19995.4	3145.59	1267.99		302.602 *	33599.8		102.315 *	57.9156 *	215.843	88.5432
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-220-WR1-B	297.632				94.8194			318.494			27.5122	
01-220-WR1-C	234.542				43.3695 *		86.811 *	1693.64		59.2487	652.932	
01-220-WR-1-COMP	266.797				81.8271		64.7751 *	1167.72		36.7156 *	313.34	

\* - Estimated Quantity

\$ - Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

LAST CHANCE NO. 2  
PA NO. 01-220



# **AIMSS SCORESHEET**

SITE NAME: LAST CHANCE #2/IER  
PA NUMBER: 01-220

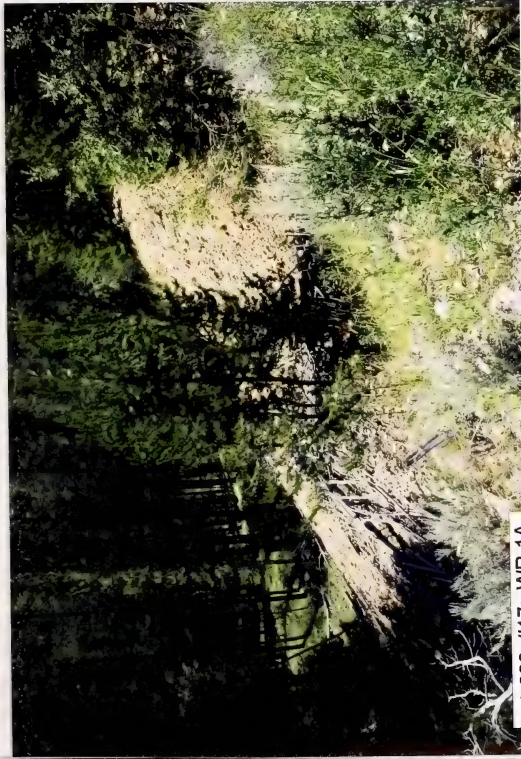
LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	2.486
6		WELLS - 1 MI. x 2.5		0.0
7	GW - TARGETS	WELLS - 1 TO 4 MI		0
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	0.0
10		<b>GROUNDWATER SCORE</b>	LINES 4 x 5 x 9	0
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		0
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		10
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	200
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	200
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	3.917
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18	SW - TARGETS	WETLANDS		0
19		FISHERY		0
20		RECREATION		0
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	2
24		<b>SURFACE WATER SCORE</b>	LINES 14 x 15 x 23	1567
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.039
29		POPULATION - 4 MILES		0
30		NEAREST RESIDENCE		0
31	AIR - TARGETS	WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	0
35		<b>AIR PATHWAY SCORE</b>	LINES 27 x 28 x 34	0
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		0
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		5
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	25
38		LIKELIHOOD SCORE	LINES 36 + 37C	25
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.025
40	DIRECT CONTACT	POPULATION - 1 MILE		0
41	TARGETS	NEAREST RESIDENCE		0
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 - 42	0
44		<b>DIRECT CONTACT SCORE</b>	LINES 38 x 39 x 43	0
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			0.02
	(LINES 10 + 24 + 35 + 44) / 100,000			

LINE  
NO.

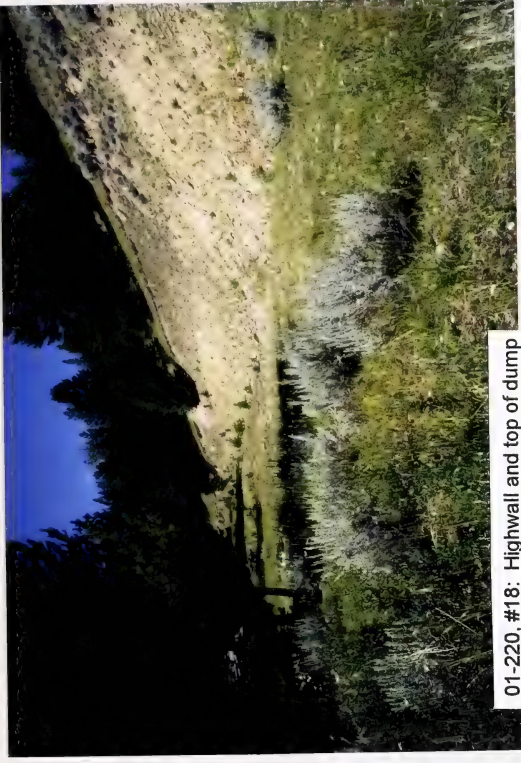
SITE NAME:  
PA NUMBER:

LAST CHANCE #2/IER  
01-220

<u>SITE SAFETY</u>				
1	THREAT	ACCESSIBILITY		5
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	40
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	40
9		POPULATION - 1 MILE		0
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 - 11	0
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>0.00</b>



01-220, #17: WR-1A



01-220, #18: Highwall and top of dump









MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: TUNGSTEN MILLSITE PA#: 01-170

Date: September 13, 1993 Time: 1300-2000

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Pierson, TD&H  
\_\_\_\_\_  
\_\_\_\_\_

Visitors: None  
\_\_\_\_\_  
\_\_\_\_\_

Weather/Seasonality Observations: Cool (40°F); partly cloudy;  
windy (10-20 mph).  
\_\_\_\_\_  
\_\_\_\_\_

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #17: Mill and GW-1  
location; #18: TP-1 (borehole); #19: TP-4; #20: TP-3.  
Video Tape No. 6  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

General Comments/Observations (not covered specifically in attached Inventory Forms):  
High radiation (from 6.5 to 8.5 bgs) in TP-1. Petroleum odor  
detected in lower clay in TP-4 (largest lower pond).  
\_\_\_\_\_  
\_\_\_\_\_

Other Hazardous Materials/Substances Present: Petroleum saturated  
tailings near bottom of TP-4.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

General Comments on Potential Remedial Alternatives: Complete  
revegetation activities; study treatment requirements for petroleum  
contamination in tailings and groundwater.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): TUNGSTEN MILLSITE PA#: 01-170

Legal Description: T 4S ; R 9W ; Sec. 4 , SW1/4 1/4 1/4  
T 4S ; R 9W ; Sec. 5 , SE1/4 SE1/4 1/4

County: BEAVERHEAD Mining District: LOST CREEK

Latitude: N 45° 30' 45" Longitude: W 112° 43' 45"

Primary Drainage Basin and Code: Big Hole River/10020004

Secondary Drainage Basin: Sassman Gulch

USGS Quadrangle map name(s): Earls Gulch

Mine Type/Commodities: Millsite/Tungsten

Activity Status: Active      , Inactive/Exploration      , Abandoned X .

Ownership status: Known YX N ; private/public? Public

Owner, Agent, or Contact (Include address and phone when available): Bureau of Land Management.

Relationship to other mines/sites in the area/district: Ore  
mined at the Lost Creek and Browns Lake mines.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? BLM has conducted a CERCLA  
Preliminary Assessment on the site and performed reclamation on  
ponds causing the largest dust problems. Barrels reported during  
the PA were also removed. MDSL was contracted by BLM to conduct  
the reclamation; MDHES was involved in the reclamation planning.  
BLM and MDHES/WQB is studying the petroleum contamination. The  
site is currently listed under the CECRA Program.

General site features: Elevation 5200'-5400' , Slope 5° ,  
Aspect Eastern

Land use: Mining      , Recreational      , Residential      , Urban      ,  
Agricultural X , Other (Specify)     

Area of disturbed/unvegetated lands? 25 acres.  
Dimensions:     

Predominant vegetation types: Sage brush, rabbit brush, salt  
brush, prickly pear, and clover

Access: roads - good X , poor      , 4wd      , trail      .  
Other logistical considerations (proximity to other sites). Very  
close to Interstate 15 off the Glen exit.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MEMG Well Log Printout(s): There are 14 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Sassman Gulch (dry) would flow in a west  
to east direction 1000 feet south of the site. Water in Sassman  
Gulch would flow into the Big Hole River approx. 1/2 miles from the  
site and the Big Hole River flows south.

Mining/milling history, ore type/tenor, host rock, gangue: The  
mill was constructed in 1953 by Minerals Engineering Co.; 646,300  
tons of ore from the Lost Creek and Brown's Lake Mines were  
processed between 1953 and 1957. Concentrates were shipped to Salt  
Lake City, Utah and processed material was delivered to the USGSA.  
The mill was shut down in 1957 and dismantled in 1976.  
Environmental investigations began in 1985. Partial reclamation  
was conducted in 1990.

Mine Operation?

Shafts - Yes\_\_\_, No X, #\_\_\_, Comment\_\_\_  
Adits - Yes\_\_\_, No X, #\_\_\_, Comment\_\_\_  
Pits - Yes\_\_\_, No X, #\_\_\_, Comment\_\_\_  
Placers - Yes\_\_\_, No X, #\_\_\_, Comment\_\_\_  
Other - Yes\_\_\_, No X, #\_\_\_, Comment\_\_\_

Mill Operation? Yes X, No\_\_\_. If yes answer the next three  
questions:

Period(s) of Operation: 1953 to 1957

Origin of Ore Milled - Custom Mill\_\_\_ Dedicated Mill X; Number and  
names of mines that supplied mill feed: Lost Creek and Brown's  
Lake

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
Floatation

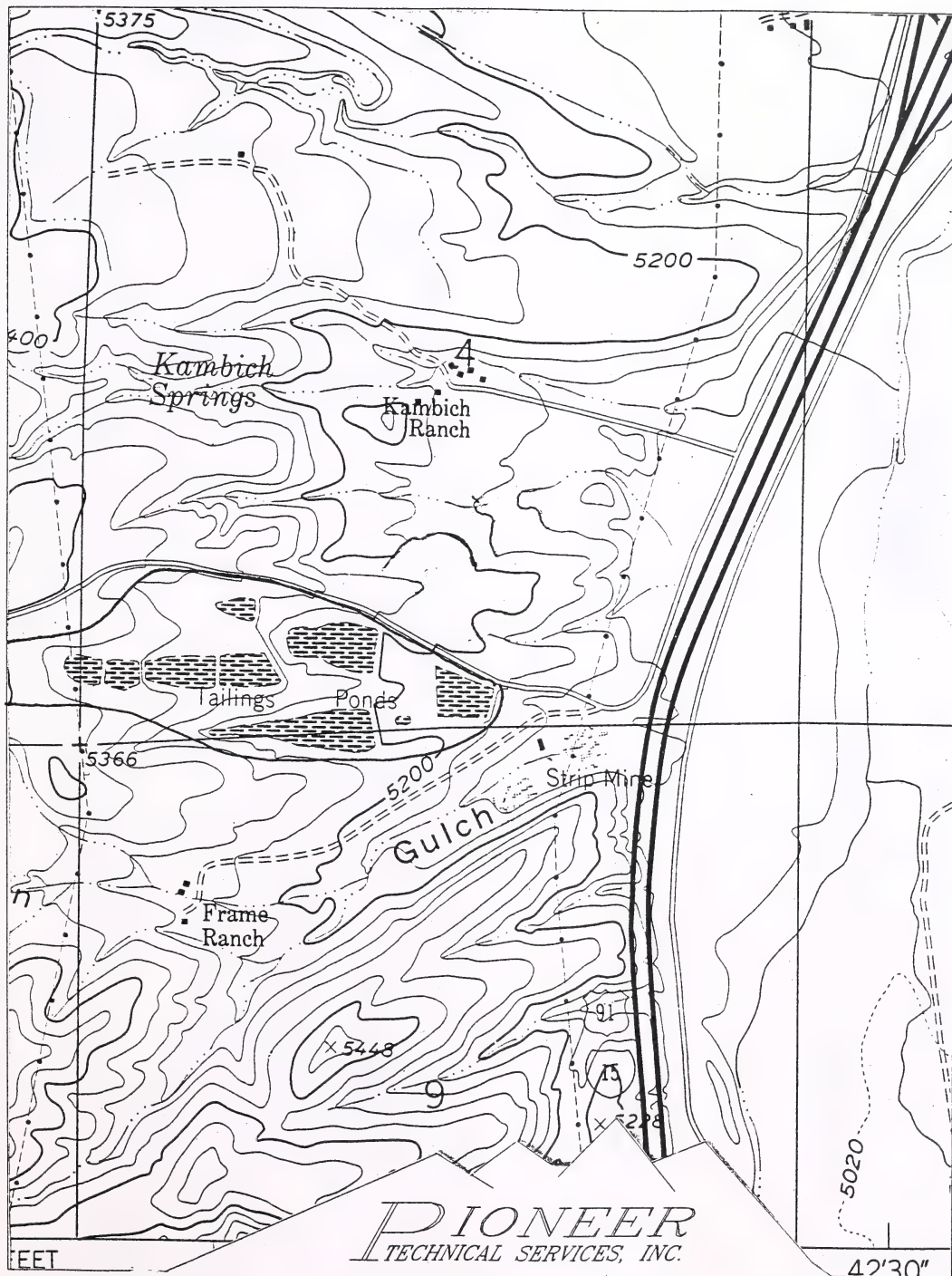


Montana Bureau of Mines and Geology  
Water Well Log Data

11/15/1993

Well No.	Location	Depth	Yield	Static Water Level
M:120022	04S 09W 03 CC	30.0	25.0	8.00
M:108183	04S 09W 04 AA	80.0	0.0	0.00
M:108184	04S 09W 04 AA	80.0	0.0	0.00
M:108182	04S 09W 04 AA	178.0	6.0	10.00
M:108185	04S 09W 05 D	40.0	100.0	20.00
M:108186	04S 09W 09 ABA	85.0	12.0	40.00
M:108187	04S 09W 09 DDA	97.0	25.0	28.00
M:107669	03S 09W 32 D	16.0	0.0	9.00
M:107670	03S 09W 33 CB	20.0	20.0	6.00
M:120983	03S 09W 33 CBB	40.0	30.0	12.00
M:107671	03S 09W 34 C	90.0	5.0	7.00
M:107672	03S 09W 34 CC	40.0	50.0	34.00
M:107673	03S 09W 34 CC	40.0	50.0	20.00
M:107674	03S 09W 34 DBD	42.0	15.0	30.00





TUNGSTEN MILL, P.A. NO. 01-170

T04S, R09W, SECTION 04

SCALE: 1" = 1000'









## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): 80% fine to medium sand; 20% silty clay

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Primarily light brown or tan with limited gray, purple, and green tailings.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): 80% dry; 20% moist in lower zones

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Most tailings impoundments are in good condition; dam at TP-7 is eroding badly.

Comments on potential for mitigation: Capping and revegetation (already done on approximately 50% of the ponds).

# SOURCE INVENTORY FORM

SAMPLERS: Bullock, Pierson\*

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	pH SU (D/S)*	RADIO-ACTIVITY (MR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
TP-1A	TAIL	46,000	Upper pond closest to mill, SE corner; 0'-3.5', brown fine sand	Impoundment	5.9 (D)	0.04	01-170-TP-1	09/14/93 1805	T-Metals, ABA
TP-1B	TAIL		Upper pond closest to mill, SE corner; 3.5'-5', green fine sand	Impoundment	4.8 (D)	0.05			
TP-1C	TAIL		Upper pond closest to mill, SE corner; 6.5'-8.5', red/purple fine sand	Impoundment	5.8 (D)	0.17	01-170-TP-2	09/14/93 1815	T-Metals, ABA
TP-1D	TAIL		Upper pond closest to mill, SE corner; 9'-10.5', light brown fine sand	Impoundment	5.2 (D)	0.04			
TP-2A	TAIL	52,000	Second pond down from mill, center; 0'-5', brown medium sand	Impoundment	6.9 (D)	0.03	01-170-TP-3	09/14/93 1810	T-Metals, ABA
TP-2B	TAIL		Second pond down from mill, center; 5'-12', light brown fine sand	Impoundment	6.9 (D)	0.04			
TP-2C	TAIL		Second pond down from mill, center; 12'-14', gray silty clay	Impoundment	5.9 (D)	0.04			
TP-3A	TAIL	107,000	Third pond down from mill, SW quarter; 0'-3', tan fine sand	Impoundment	6.9 (D)	0.04			
TP-3B	TAIL		Third pond down from mill, SW quarter; 3'-9', tan fine sand	Impoundment	5.9 (D)	0.03			
TP-3C	TAIL		Third pond down from mill, SW quarter; 9'-15', tan fine sand	Impoundment	6.2 (D)	0.04			
TP-4A	TAIL	157,000	Pond south of TP-3, SE corner; 0'-3', brown fine sand	Impoundment	7.0 (D)	0.04			
TP-4B	TAIL		Pond south of TP-3, SE corner; 3'-11', Brown sand/clay layers	Impoundment	6.2 (D)	0.03			
TP-4C	TAIL		Pond south of TP-3, SE corner; 11'-14.5', gray clay with a petro odor	Impoundment	5.8 (D)	0.04	01-170-TP-4	09/14/93 1825	TPH, T-Metals, ABA

\*Direct reading (dry Matter), B-Saturated Petro (Dry Matter)

Comments or deviations from SOPs: 01-170-TP-1 is composite of TP-1A, -1B, and -1D. 01-170-TP-2 is grab of TP-1C. 01-170-TP-3 is composite of TP-2A through -2C, TP-3A through -3C, and TP-4A and -4B. 01-170-TP-4 is grab of TP-4C.

\*Continued on next page

SAMPLERS: Bullock, Pierson

[illegible]

D-Direct reading (Railway Meter); S-Saturated Paste (Orion Meter)

Comments or deviations from SOPs: 01-170-TP-5 is grab of TP-6. 01-170-WR-1 is composite of WR-1A and -1B.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes     , No X, Number:      Identification:     

Filled shafts: Yes     , No X, Number:      Identification:     

Seeps/Springs: Yes X, No     , Number: 1 Identification: Spring below ponds is used for irrigation by the residents.

Groundwater wells within 4 miles?: Yes X, No     ,  
Number of well logs: 58

Distance to nearest well used for drinking? 200 feet below lowest tailings pond (TP-8)

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite     , Probable     , Possible X, Unlikely     .

Tailings may or may not be in contact with groundwater; elevated metals are present.

Other observations/notes: Total petroleum hydrocarbons measured at 23.3 mg/l in downgradient residential well.



**SAMPLERS:** Bullock, Pierson

[illegible]

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

 Comments or Deviations from the SOPs (Pioneer SAP, 1993): | NM = Not Measured |

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes     , No X, Name(s):                     

Dry streambeds: Yes X, No     , Name(s): Sassman Gulch flows parallel to the site to the south.

Other surface water: Yes X, No     , Name(s)/Description: Ponded water on TP-1 and -2.

Waste materials within any floodplain: Yes     , No X Source ID(s):     

Approximate Flood frequency?      1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)? N/A  
High Flow:                     , Average Flow:                     

Distance between waste source(s) and nearest surface water body (ft)?       
1,000 feet to Sassman Gulch drainage; 1/2 mile to the Big Hole River

Surface water draining onto or through waste sources: Yes X, No     ,  
Describe: Limited runoff paths through tailings

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Irrigation, fishery, wetlands, possible domestic use, recreation, agriculture, bald eagle habitat

Observed erosional/sedimentation/stream turbidity problems? Yes X, No     , Distance downstream (ft)? N/A Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):       
Minor erosion occurring within TP-2, -3, and -6.



## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

#### D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

##### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

##### General Potential for AMD Mitigation:

Area available for treatment (acres)? Approximately 25 acres on-site

Wetlands present: Yes X, No     , Describe: Small wetlands upgradient from the tailings

Carbonate rocks/soils: Yes X, No     , Describe: High calcium numbers in tailings material indicate presence of carbonates.

#### E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius? 1-10     ; 10-30     ; 30-100     ; 100-300     ; 300-1,000 X; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ; Comments     

Nearest residence(ft or miles)? 200 feet

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none

# ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Bullock, Pierson

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LINES)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (PERCENT)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH/NO DEBRIS/LOW/NONE)
TP-1	Low pH	Partial	113,250	11,325	Yes	Low
TP-2	Low pH	Partial	100,200	60,120	Yes	Moderate
TP-3	Low pH	Partial	143,750	28,750	Yes	Moderate
TP-4	Low pH	Partial	169,900	16,990	Yes	Low
TP-5	Low pH	Dry	191,660	38,332	Yes	Low
TP-6	None	Dry	52,275	15,680	Yes	Moderate
TP-7	None	Dry	43,560	17,424	Yes	Moderate
TP-8	None	Dry	100,200	50,100	Yes	Moderate
WR-1	Low pH; sulfides	Dry	54,000	37,800	No	Low

Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes X, No     ,  
Describe: Trailer below TP-8

Population within 1 mile: 1-10     ; 10-30 X; 30-100     ; 100-300     ;  
300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ;  
Comments     

Evidence of recreational use on site: Yes     , No X, Describe:     

Accessibility - Fences, warning signs, closed roads? Barbed wire  
fence; no signs

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes <u>    </u> , No <u>X</u> , Comment <u>    </u>
Wilderness Area -	Yes <u>    </u> , No <u>X</u> , Comment <u>    </u>
T&E Species Habitat -	Yes <u>X</u> , No <u>    </u> , Comment <u>Bald Eagle</u>
Bat Habitat -	Yes <u>    </u> , No <u>X</u> , Comment <u>    </u>

Primary Drainage X; Secondary Drainage     ; No Information     :

Riparian Habitat Quality -	High <u>X</u> , Medium <u>    </u> , Low <u>    </u>
Wetlands Frontage -	High <u>X</u> , Medium <u>    </u> , Low <u>    </u>
Fisheries Habitat and Species Classification -	<u>2</u>
Sport Fishery Classification -	<u>1</u>

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes     , No X, Number     , types and locations:     

Hazardous structures: Yes     , No X, Number     , types and locations:     

Unstable highwalls, pits, trenches, slopes: Yes X, No     , Number     ,  
types and locations: Loadout wall is approx. 15 feet high.

Unstable waste piles, impoundments, undercut banks: Yes X, No     ,  
Number 1, types and locations: TP-6 is eroding.

Fire and/or Explosion hazards: Yes     , No X, Explain:



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LABORATORY ANALYTICAL DATA

TUNGSTEN MILLSITE  
PA NO. 01-170



# SOLID MATRIX ANALYSES

Results per dry weight basis

Metals in soils

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	Total Petroleum Hydrocarbons (mg/kg)
01-170-TP-1	7.5 J	89.2	0.89 U	7.35	11.6	107	32500	0.054 J	4380	10.1	17.9	6.39 J	119	NR
01-170-TP-2	107 J	2620	0.73	17.8	7.94	123	17600	0.475 J	14900	29.5	35.1	19.9 J	79.6	NR
01-170-TP-3	88.9 J	88.9	1.48	7.5	9.78	189	39200	0.087 J	4670	10.4	31.5	6.59 UJ	125	NR
01-170-TP-4	12.6 J	41.6	2.81	12.7	15.5	567	62500	0.143 J	5310	16.5	123	6.78 UJ	154	611
01-170-TP-5	8.03 J	134	1.72	16.2	16.5	331	47900	0.071 J	7000	21.8	7.36	10.5 J	468	NR
01-170-WR-1	6.28 J	40.9	2.29	9.59	6.08	2380	28600	0.054 J	2310	10.7	8.87	18.5 J	323	NR
BACKGROUND	56	169	0.8 JX	13.8	29.4	34.2	25300	0.014 U	462	26	30	4 UJ	119	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

## Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL SULFUR ACID BASE 1/1000	NEUTRAL POTENT. 1/1000	SULFUR ACID BASE POTENT. 1/1000	SULFATE %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE POTENT. 1/1000	SULFUR ACID BASE POTENT. 1/1000
01-170-TP-1	<0.01	0	165	<0.01	<0.01	<0.01	0.02	0	165
01-170-TP-2	<0.01	0	47.7	<0.01	<0.01	<0.01	<0.01	0	47.7
01-170-TP-3	0.01	0.31	125	<0.01	<0.01	<0.01	0.01	0	125
01-170-TP-4	0.03	0.94	135	134	0.01	0.02	0.02	0	135
01-170-TP-5	0.06	1.87	206	204	0.05	<0.01	0.01	0	206
01-170-WR-1	<0.01	0	131	<0.01	<0.01	<0.01	<0.01	0	131

# WATER MATRIX ANALYSES

Results in ug/L

Metals in Water

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
01-170-GW-1	3.39	97.5	4.59 U	5 U	6.24 U	2.33 U	53.1	0.12 U	3.76 U	10.9 U	1.22 U	31.7 U	8.71 U	309
01-170-GW-2	2.09	29.1	4.59 U	5 U	6.24 U	2.33 U	24.4	0.15 J	4.6	10.9 U	2.17	31.7 U	69.3	175

## Wet Chemistry

Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	TOTAL PETROLEUM HYDROCARBONS (mg/L)
01-170-GW-1	408	31	60	0.64	23.3
01-170-GW-2	234	9	16	0.4	NR

## LEGEND

TP1 - Composite of subsamples TP1A, 1B, and 1D.  
 TP2 - Sample of the TP1C subsample.  
 TP3 - Composite of subsamples TP2A, 2B, 2C, 3A, 3B, 3C, 4A, and 4B.  
 TP4 - Sample of the TP4C subsample.  
 TP5 - Sample of the TP6A subsample.  
 WR1 - Composite of subsamples WR1A and 1B.  
 BACKGROUND - From the Emma Mine (29-061-SS-1).  
 GW1 - Downgradient sample at trailer; below tailings pond 8  
 GW2 - Water supply well for mill; converted to resistance.



XRF ANALYSIS RESULTS

TUNGSTEN MILLSITE  
PA NO. 01-170





\* - Estimated Quantity  
\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

TUNGSTEN MILLSITE  
PA NO. 01-170



# AIMSS SCORESHEET

SITE NAME: TUNGSTEN MILLSITE  
PA NUMBER: 01-170

LINE NO.			PA NUMBER:	01-170
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		300
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	500
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	4.524
6		WELLS - 1 MI. x 2.5		35.0
7	GW - TARGETS	WELLS - 1 TO 4 MI		44
8		NEAREST WELL		10
9		TARGETS SCORE	LINES 6 + 7 + 8	89.0
10		GROUNDWATER SCORE	LINES 4 x 5 x 9	201318
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		0
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		2
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	40
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	40
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	8.357
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18	SW - TARGETS	WETLANDS		10
19		FISHERY		0
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		5
23		TARGETS SCORE	SUM LINES 16 - 22	22
24		SURFACE WATER SCORE	LINES 14 x 15 x 23	7354
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		15
26B		DISTANCE TO POPULATION		20
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	300
27		LIKELIHOOD SCORE	LINES 25 + 26C	300
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.028
29		POPULATION - 4 MILES		300
30	AIR - TARGETS	NEAREST RESIDENCE		10
31		WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		5
34		TARGETS SCORE	SUM LINES 29 - 33	325
35		AIR PATHWAY SCORE	LINES 27 x 28 x 34	2730
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		200
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		20
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	200
38		LIKELIHOOD SCORE	LINES 36 + 37C	400
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.008
40	DIRECT CONTACT	POPULATION - 1 MILE		10
41	TARGETS	NEAREST RESIDENCE		10
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 - 42	20
44		DIRECT CONTACT SCORE	LINES 38 x 39 x 43	64
45	TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE (LINES 10 + 24 + 35 + 44) / 100,000			2.11

LINE NO.				SITE NAME:	TUNGSTEN MILLSITE
				PA NUMBER:	01-170
	<b>SITE SAFETY</b>				
1	THREAT	ACCESSIBILITY			10
2		OPEN SHAFTS	100 EA.		0
3		OPEN ADITS	50 EA.		0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.		75
5		HAZ. STRUCTURES	40 EA.		0
6		EXPLOSIVES			0
7		HAZ. MATERIALS			100
8		HAZARDS SCORE	SUM LINES 2 - 7		175
9		POPULATION - 1 MILE			10
10	TARGETS	NEAREST RESIDENCE			10
11		RECREATIONAL USE			0
12		TARGETS SCORE	SUM LINES 9 - 11		20
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>		<b>35.00</b>



**SUMMARY OF HISTORICAL ANALYTICAL DATA  
FROM OTHER SOURCES**



PRELIMINARY ASSESSMENT (PA) REPORT  
FOR  
TUNGSTEN MILL-MILL TAILING SITE  
GLEN, BEAVERHEAD COUNTY, MONTANA

BLM Site Code: MT 01411A0002  
AEPCO Site No. 10 Group D

(FINAL REPORT)

Under BLM Contract No. AA352-CT5-03  
AEPCO Project No. 1200.1730

Submitted to:  
Department of the Interior  
Bureau of Land Management (BLM)  
18th and C Streets, N.W.  
Washington, D.C. 20240

Submitted by:  
AEPCO, Inc.  
5272 River Road, Suite 600  
Bethesda, Maryland 20816  
Tel. (301) 951-6400

3 October 1986

**TABLE 4-1**  
**CONCENTRATIONS OF HSL METALS AND OTHER PARAMETERS IN WASTE**  
**AND SURFACE WATER SAMPLES**

TUNGSTEN MILL-MILL TAILING SITE, GLEN, BEAVERHEAD COUNTY, MONTANA.  
 BLM SITE CODE: MT 1411A0002  
 AEPDO SITE 10, GROUP D

PARAMETER	WASTE			RCRA STANDARD***	SURFACE WATER			NATIONAL DRINKING WATER STANDARD #
	UNIT	STATION WS-A*	DETECTION LIMIT**		UNIT	STATION SW-A	DETECTION LIMIT**	
Silver (Ag)	ug/L	< 10	5,000	5,000	ug/L	<10	10	50
Arsenic (As)	ug/L	< 10	5,000	5,000	ug/L	50	10	50
Boron (B)	ug/L	---	---	---	ug/L	329	---	---
Barium (Ba)	ug/L	333	100,000	100,000	ug/L	---	---	---
Beryllium (Be)	ug/L	---	---	---	ug/L	24	5	---
Cadmium (Cd)	ug/L	< 5	1,000	1,000	ug/L	8	5	*0
Cobalt (Co)	ug/L	---	---	---	ug/L	<50	50	---
Chromium (Cr)	ug/L	---	5,000	5,000	ug/L	48	10	50
Copper (Cu)	ug/L	---	---	---	ug/L	1,170	25	1,000
Mercury (Hg)	ug/L	< 0.2	200	200	ug/L	1.0	0.2	2
Manganese (Mn)	ug/L	---	---	---	ug/L	7,790	15	50
Nickel (Ni)	ug/L	---	---	---	ug/L	71	40	---
Lead (Pb)	ug/L	< 5	5,000	5,000	ug/L	20	5	---
Selenium (Se)	ug/L	< 5	1,000	1,000	ug/L	<5	5	---
Thallium (Te)	ug/L	---	---	---	ug/L	<10	10	---
Vanadium (V)	ug/L	---	---	---	ug/L	925	50	---
Tungsten (W)	ug/L	8,790	---	---	ug/L	29,800	---	---
Gold (Au)	ug/L	---	---	---	ug/L	---	---	---
Iron (Fe)	ug/L	---	---	---	ug/L	---	100	300
Zinc (Zn)	ug/L	---	---	---	ug/L	---	20	5,000
Percent Solids	(%)	92.05	---	---	---	---	---	---
Ignitability: Flash Point	deg. F	>200	---	---	---	---	---	---
Corrosivity: pH	Std. Unit	9.2##	---	<2 or >12	---	---	---	6.5-8.5
Reactivity:								
Total Sulfide	mg/Kg	0.58	---	---	---	---	---	---
Total Cyanide	mg/Kg	< 0.5	---	---	---	---	---	---
Cyanide	---	---	---	---	ug/L	< 10	---	---

10

WS-A = Waste Sample

SW-A = Surface Water Sample

\* Extraction Procedure (EP) toxicity test results

\*\* EPA detection limits based on zero dilution

\*\*\* Resource Conservation and Recovery Act

# National Interim Primary and Secondary Drinking Water Standards

## pH greater than 2 and less than 12 indicates noncorrosive characteristics.

ND = Not detected or below detection limit

--- Not applicable or analysis not requested.

**TABLE 4-2**  
**CONCENTRATIONS OF VOLATILE ORGANIC COMPOUNDS IN WASTE AND**  
**SURFACE WATER SAMPLES**

TUNGSTEN MILL-MILL TAILING SITE, GLEN, BEAVERHEAD COUNTY, MONTANA.  
 BLM SITE CODE: MT 01411A0002  
 AEPCO SITE 10; GROUP D

PARAMETER	WASTE			SURFACE WATER		
	UNIT	STATION WS-A	DETECTION LIMIT	UNIT	STATION SW-A	DETECTION LIMIT
Acetone	ug/Kg	110	10	ug/L	ND	5
Benzene	ug/Kg	ND	10	ug/L	ND	5
Bromoform	ug/Kg	ND	10	ug/L	ND	5
2-Butanone	ug/Kg	ND	10	ug/L	ND	5
Carbon Tetrachloride	ug/Kg	ND	10	ug/L	ND	5
Carbon Disulfide	ug/Kg	ND	10	ug/L	ND	5
Chlorobenzene	ug/Kg	ND	10	ug/L	ND	5
Chlorodibromomethane	ug/Kg	ND	10	ug/L	ND	5
Chloroethane	ug/Kg	ND	10	ug/L	ND	5
2-Chloroethylvinylether	ug/Kg	ND	10	ug/L	ND	5
Chloroform	ug/Kg	ND	10	ug/L	ND	5
cis-1,3-Dichloropropane	ug/Kg	ND	10	ug/L	ND	5
Dichlorobromomethane	ug/Kg	ND	10	ug/L	ND	5
1,1-Dichloroethane	ug/Kg	ND	10	ug/L	ND	5
1,2-Dichloroethane	ug/Kg	ND	10	ug/L	ND	5
1,1-Dichloroethylene	ug/Kg	ND	10	ug/L	ND	5
1,2-Dichloropropane	ug/Kg	ND	10	ug/L	ND	5
Trans-1,3-Dichloropropene	ug/Kg	ND	10	ug/L	ND	5
Ethylbenzene	ug/Kg	ND	10	ug/L	ND	5
2-Hexanone	ug/Kg	ND	10	ug/L	ND	5
Methyl bromide	ug/Kg	ND	10	ug/L	ND	5
Methyl chloride	ug/Kg	ND	10	ug/L	ND	5
Methylene Chloride	ug/Kg	ND	10	ug/L	ND	5
4-Methy-2-Pentanone	ug/Kg	ND	10	ug/L	ND	5
Styrene	ug/Kg	ND	10	ug/L	ND	5
1,1,2,2-Tetrachloroethane	ug/Kg	ND	10	ug/L	ND	5
Tetrachloroethylene	ug/Kg	ND	10	ug/L	ND	5
Toluene	ug/Kg	ND	10	ug/L	ND	5
1,2-trans-Dichloroethylene	ug/Kg	ND	10	ug/L	ND	5
1,1,1-Trichloroethane	ug/Kg	ND	10	ug/L	ND	5
1,1,2-Trichloroethane	ug/Kg	ND	10	ug/L	ND	5
Trichloroethylene	ug/Kg	ND	10	ug/L	ND	5
Trichlorofluoromethane	ug/Kg	ND	10	ug/L	ND	5
Vinyl Chloride	ug/Kg	ND	10	ug/L	ND	5
Vinyl Acetate	ug/Kg	ND	10	ug/L	ND	5
Total Xylenes	ug/Kg	ND	10	ug/L	ND	5
DILUTION RATIO	---	1X	1X	---	1X	1X

WS-A = Waste Sample

SW-A = Surface Water Sample

ND = Not detected or below detection limit

--- Not applicable

**TABLE 4-3**  
**CONCENTRATIONS OF ACID BASE EXTRACTABLE ORGANIC COMPOUNDS**  
**IN WASTE AND SURFACE WATER SAMPLES**

TUNGSTEN MILL-MILL TAILING SITE, GLEN, BEAVERHEAD COUNTY, MONTANA.  
 BLM SITE CODE: MT 01411A0002  
 AEP CO SITE 10; GROUP D

PARAMETER	WASTE			SURFACE WATER		
	UNIT	STATION WS-A	DETECTION LIMIT	UNIT	STATION SW-A	DETECTION LIMIT
Benzonic Acid	ug/Kg	ND	5,000	ug/l	ND	50
2-Chlorophenol	ug/Kg	ND	1,000	ug/l	ND	10
2,4-Dichlorophenol	ug/Kg	ND	1,000	ug/l	ND	10
2,4-Dimethylphenol	ug/Kg	ND	1,000	ug/l	ND	10
4,6-Dinitro-o-cresol	ug/Kg	ND	5,000	ug/l	ND	50
2,4-Dinitrophenol	ug/Kg	ND	5,000	ug/l	ND	50
2-Methylphenol	ug/Kg	ND	1,000	ug/l	ND	10
4-Methylphenol	ug/Kg	ND	1,000	ug/l	ND	10
2-Nitrophenol	ug/Kg	ND	1,000	ug/l	ND	10
4-Nitrophenol	ug/Kg	ND	5,000	ug/l	ND	50
p-Chloro-m-cresol	ug/Kg	ND	1,000	ug/l	ND	10
Pentachlorophenol	ug/Kg	ND	5,000	ug/l	ND	50
Phenol	ug/Kg	ND	1,000	ug/l	ND	10
2,4,5-Trichlorophenol	ug/Kg	ND	5,000	ug/l	ND	50
2,4,6-Trichlorophenol	ug/Kg	ND	1,000	ug/l	ND	10
DILUTION RATIO	---	100X	100X	---	10X	10X

WS-A = Waste Sample

SW-A = Surface Water Sample

--- Not applicable

ND = Not detected or below detection limit

\* = Found below method detection limit



# TABLE 4-4 CONCENTRATIONS OF BASE NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS IN WASTE AND SURFACE WATER SAMPLES

TUNGSTEN MILL-MILL TAILING SITE, GEN, BEAVERHEAD COUNTY, MONTANA.  
BLM SITE CODE: MT 1411A0002  
AEPCC SITE 10; GROUP D

PARAMETER	UNIT	WASTE-		UNIT	SURFACE WATER	
		STATION WS-A	DETECTION LIMIT		STATION SW-A	DETECTION LIMIT
Acenaphthene	ug/Kg	ND	1,000	ug/L	ND	10
Acenaphthylene	ug/Kg	ND	1,000	ug/L	ND	10
Aniline	ug/Kg	ND	1,000	ug/L	ND	10
Anthracene	ug/Kg	ND	1,000	ug/L	ND	10
Benzo (a) anthracene	ug/Kg	ND	1,000	ug/L	ND	10
Benzo (a) pyrene	ug/Kg	ND	1,000	ug/L	ND	10
Benzo (b) fluoranthene	ug/Kg	ND	1,000	ug/L	ND	10
Benzo (ghi) perylene	ug/Kg	ND	1,000	ug/L	ND	10
Benzo (k) fluoranthene	ug/Kg	ND	1,000	ug/L	ND	10
Benztidine	ug/Kg	ND	1,000	ug/L	ND	10
Benzyl alcohol	ug/Kg	ND	1,000	ug/L	ND	10
3,4-Benzofluoranthene	ug/Kg	ND	1,000	ug/L	ND	10
Bis (2-chloroethyl) ether	ug/Kg	ND	1,000	ug/L	ND	10
Bis (2-chloroisopropyl) ether	ug/Kg	ND	1,000	ug/L	ND	10
Bis (2-chloroethoxy) methane	ug/Kg	ND	1,000	ug/L	ND	10
Bis (2-chloroisopropyl) ether	ug/Kg	ND	1,000	ug/L	ND	10
Bis (2-ethylhexyl) phthalate	ug/Kg	ND	1,000	ug/L	ND	10
4-Bromophenyl phenyl ether	ug/Kg	ND	1,000	ug/L	ND	10
Butyl benzyl phthalate	ug/Kg	ND	1,000	ug/L	ND	10
4-Chloroaniline	ug/Kg	ND	1,000	ug/L	ND	10
2-Chloronaphthalene	ug/Kg	ND	1,000	ug/L	ND	10
4-Chlorophenyl phenyl ether	ug/Kg	ND	1,000	ug/L	ND	10
Chrysene	ug/Kg	ND	1,000	ug/L	ND	10
Dibenzo (a,h) anthracene	ug/Kg	ND	1,000	ug/L	ND	10
Dibenzofuran	ug/Kg	ND	1,000	ug/L	ND	10
1,2-Dichlorobenzene	ug/Kg	ND	1,000	ug/L	ND	10
1,3-Dichlorobenzene	ug/Kg	ND	1,000	ug/L	ND	10
1,4-Dichlorobenzene	ug/Kg	ND	1,000	ug/L	ND	10
3,3-Dichlorobenzidine	ug/Kg	ND	1,000	ug/L	ND	10
2,4-Dinitrotoluene	ug/Kg	ND	1,000	ug/L	ND	10
2,5-Dinitrotoluene	ug/Kg	ND	1,000	ug/L	ND	10
1,2-Dibenzylhydrazine (as azobenzene)	ug/Kg	ND	1,000	ug/L	ND	10
Dibenzyl phthalate	ug/Kg	ND	1,000	ug/L	ND	10
Dibenzoyl phthalate	ug/Kg	ND	1,000	ug/L	ND	10
Diethyl phthalate	ug/Kg	ND	1,000	ug/L	ND	10
Dimethyl phthalate	ug/Kg	ND	1,000	ug/L	ND	10
Fluoranthene	ug/Kg	ND	1,000	ug/L	ND	10
Fluorene	ug/Kg	ND	1,000	ug/L	ND	10
Hexachlorobenzene	ug/Kg	ND	1,000	ug/L	ND	10
Hexachloroethane	ug/Kg	ND	1,000	ug/L	ND	10
Hexachlorocyclopentadiene	ug/Kg	ND	1,000	ug/L	ND	10
Hexachlorocyclopentadiene	ug/Kg	ND	1,000	ug/L	ND	10
Indeno (1,2,3-cd) pyrene	ug/Kg	ND	1,000	ug/L	ND	10
Isonorone	ug/Kg	ND	1,000	ug/L	ND	10
2-Methylnaphthalene	ug/Kg	ND	1,000	ug/L	ND	10
Naphthalene	ug/Kg	ND	1,000	ug/L	ND	10
2-Nitroaniline	ug/Kg	ND	1,000	ug/L	ND	10
3-Nitroaniline	ug/Kg	ND	1,000	ug/L	ND	10
4-Nitroaniline	ug/Kg	ND	1,000	ug/L	ND	10
Nitrobenzene	ug/Kg	ND	1,000	ug/L	ND	10
N-Nitrosodimethylamine	ug/Kg	ND	1,000	ug/L	ND	10
N-Nitrosodiphenylamine	ug/Kg	ND	1,000	ug/L	ND	10
N-Nitrosodi-N-Propylamine	ug/Kg	ND	1,000	ug/L	ND	10
Phenanthrene	ug/Kg	ND	1,000	ug/L	ND	10
Pyrene	ug/Kg	ND	1,000	ug/L	ND	10
1,2,4-Trichlorobenzene	ug/Kg	ND	1,000	ug/L	ND	10
DILUTION RATIO	---	1X	1X	---	1X	1X

WS-A = Waste Sample

SW-A = Surface Water Sample

ND = Not detected or below detection limit

--- = Not applicable

\* = Found below method detection limit

+ = GC/MS search indicated that the sample contained molecular sulfur.

**TABLE 4-5**  
**CONCENTRATIONS OF PESTICIDE AND PCBs IN**  
**WASTE AND SURFACE WATER SAMPLES**

TUNGSTEN MILL-MILL TAILING SITE, GLEN, BEAVERHEAD COUNTY, MONTANA.  
 9LM SITE CODE: MT 1411A0002  
 AEPCO SITE 10; GROUP D

PARAMETER	WASTE			SURFACE WATER		
	UNIT	STATION WS-A	DETECTION LIMIT	UNIT	STATION SW-A	DETECTION LIMIT
Aldrin	ug/Kg	ND	1,000	ug/L	ND	10
Alpha-BHC	ug/Kg	ND	1,000	ug/L	ND	10
Beta-BHC	ug/Kg	ND	1,000	ug/L	ND	10
Gamma-BHC	ug/Kg	ND	1,000	ug/L	ND	10
Delta-BHC	ug/Kg	ND	1,000	ug/L	ND	10
Chlorodane	ug/Kg	ND	1,000	ug/L	ND	10
4,4'-DDT	ug/Kg	ND	1,000	ug/L	ND	10
4,4'-DDE	ug/Kg	ND	1,000	ug/L	ND	10
4,4'-DDD	ug/Kg	ND	1,000	ug/L	ND	10
Dieldrin	ug/Kg	ND	1,000	ug/L	ND	10
Alpha-Endosulfan	ug/Kg	ND	1,000	ug/L	ND	10
Beta-Endosulfan	ug/Kg	ND	1,000	ug/L	ND	10
Endosulfan sulfate	ug/Kg	ND	1,000	ug/L	ND	10
Endrin	ug/Kg	ND	1,000	ug/L	ND	10
Endrin aldehyde	ug/Kg	ND	1,000	ug/L	ND	10
Heptachlor	ug/Kg	ND	1,000	ug/L	ND	10
Heptachlor epoxide	ug/Kg	ND	1,000	ug/L	ND	10
PCB-1242 (Aroclor 1242)	ug/Kg	ND	1,000	ug/L	ND	10
PCB-1254 (Aroclor 1254)	ug/Kg	ND	1,000	ug/L	ND	10
PCB-1221 (Aroclor 1221)	ug/Kg	ND	1,000	ug/L	ND	10
PCB-1232 (Aroclor 1232)	ug/Kg	ND	1,000	ug/L	ND	10
PCB-1248 (Aroclor 1248)	ug/Kg	ND	1,000	ug/L	ND	10
PCB-1260 (Aroclor 1260)	ug/Kg	ND	1,000	ug/L	ND	10
PCB-1016 (Aroclor 1016)	ug/Kg	ND	1,000	ug/L	ND	10
Toxaphene	ug/Kg	ND	10,000	ug/L	ND	100
DILUTION RATIO	---	100X	10,000X	---	1X	1X

WS-A = Waste Sample

SW-A = Surface Water Sample

ND = Not detected or below detection limit

--- Not applicable

# Office Memorandum

GILLON RESOURCE AREA	
ACT INFO	NOTED
AM	
ADM	
LDS & MIN	
FORESTRY	
WATERSHED	
NAT RES	RJ6 11-3-86
ENG	
REC	
WILDLIFE	
RANGE	
Sampler	V.A.

ST/ DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

#MT-01411AC002

TO: Vic Anderson, SHWB

DATE: October 17, 1986

FROM: Kevin Kirley  
Chemistry Laboratory

SUBJECT: Analytical Report

## 1. Sample Description

Date (Collected) 3/4/86 (Received) 3/5/86

Lab No. Sample No. Identification

SW9560	#6	Drum labeled LAS acid, granular tailings
SW9561	#1	Whitish powder with lumps from drum
SW9562	#2	White crystalline chunks from pile
SW9563	#3	Material from domestic well
SW9564	#4	White powdery material from drum
SW9565	#5	Small white balls from mill

## 2. Results

Analyte	Laboratory Numbers	Units
	9560 9561 9562 9563 9564 9565	
Metals Scan	(Attached)	mg/l
Silver	<.01	
Arsenic	.001	
Barium	.09	
Cadmium	<.001	
Chromium	<.005	
Iron	<.01	
Mercury	<.0002	
Manganese	<.005	
Lead	<.005	
Selenium	<.002	

No Analysis

## 3. Quality Control

Analyte	(A) Precision		(B) Accuracy		(C) EPA Reference	
	Results	Limits	Results	Limits	Results	Limits
Silver	<.01/<.01	.02	92	76-111	.97	1.00 (TV)
Arsenic	.071/.069	.005	97	85-133	.027	.018-.031
Barium	.1/.09	.10	100	79-112	.346	.334 (TV)
Cadmium	<.001/<.001	.005	104	86-113	.0062	.005-.008
Chromium	<.005/<.005	.003	114	64-156	.007	.003-.006
Iron	.01/.01	.01	100	85-116	.806	.695-.881
Mercury	<.0002/<.0002	.0002	88	78-178	Not Done	-----
Manganese	<.005/<.005	.010	100	88-115	.478	.420-.530
Lead	<.005/<.005	.005	96	80-120	.029	.023-.039
Selenium	<.002/<.002	.003	110	70-124	.007	.004-.012

FILE 33  
W9563

DOMESTIC  
WELL

						PEAK OFFSET
						PEAK OFFSET
BB000		0.128				
BB000		0.008				
MD000	AV	0.014	BD	0.0101	CV	0.5
CF000	AV	0.008	BD	0.0012	CV	19.7
BB000	AV	0.008	BD	0.0117	CV	33.3
BB000	AV	0.408	BD	0.0233	CV	5.7
BI000	AV	18.14	BD	0.198	CV	1.1
ZN000	AV	0.017	BD	0.0088	CV	20.9
FE000	AV	-0.003	BD	0.0060	CV	273.2
CD000	AV	0.004	BD	0.0016	CV	39.8
CD000	AV	0.003	BD	0.0015	CV	38.3
NIG00	AV	0.017	BD	0.0034	CV	30.8
MN000	AV	0.003	BD	0.0022	CV	70.0
FE000	AV	0.017	BD	0.0032	CV	33.1
MC000	AV	12.3	BD	0.17	CV	1.4
V000	AV	0.015	BD	0.0004	CV	3.5
AL000	AV	0.004	BD	0.0108	CV	42.8
BE000	AV	0.003	BD	0.0016	CV	67.2
CA000	AV	34.3	BD	1.34	CV	1.4
CU000	AV	0.003	BD	0.0031	CV	49.9

09562

4776  
INSTALLING  
LINKS

[illegible]

660  
 KANULAR  
 FILINGS

FE000F		0.033						PEAK	OFFSET
MN000F								OVER	RANGE
FE000F		3.759						PEAK	OFFSET
AL000F		2.374						OVER	STD
FE000F		0.033						PEAK	OFFSET
MN000F								OVER	RANGE
FE000F		3.759						PEAK	OFFSET
AL000F		2.383						OVER	STD
MO000F	AV	0.033	SD	0.0031	CV	15.2			
OR000F	AV	0.033	SD	0.0048	CV	21.6			
FE000F	AV	0.033	SD	0.0017	CV	5.1			
FO000F	AV	0.441	SD	0.0013	CV	4.9			
SI000F	AV	3.91	SD	0.033	CV	0.3			
EN000F	AV	0.159	SD	0.0048	CV	8.2			
PS000F	AV	-0.083	SD	0.0037	CV	37.8			
OT000F	AV	0.019	SD	0.0006	CV	6.4			
LO000F	AV	0.017	SD	0.0033	CV	35.0			
NI000F	AV	0.033	SD	0.0036	CV	15.4			
MN000F								OVER	RANGE
FE000F	AV	3.759	SD	0.0000	CV	0.0			
MO000F	AV	7.1	SD	0.05	CV	0.2			
VO000F	AV	0.033	SD	0.0016	CV	6.0			
AL000F	AV	2.383	SD	0.0034	CV	1.3			
FE000F	AV	0.011	SD	0.0014	CV	12.7			
CA000F	AV	35.3	SD	1.31	CV	1.9			
CU000F	AV	0.103	SD	0.0049	CV	4.7			



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PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
OVER STD
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
PEAK OFFSET
OVER STD

```

1956  
 Brown  
 Robert M. M.C.

EE00F		0.70-				OVER RANGE
EE00F		1.219				PEAK OFFSET
EE00F		33.93				PEAK OFFSET
EE00F		-1.333				OVER STD
EE00F		0.051				PEAK OFFSET
EE00F		0.131				PEAK OFFSET
EE00F		3.540				PEAK OFFSET
EE00F		3.753				PEAK OFFSET
AL00F						OVER RANGE
CA00F		133.3				PEAK OFFSET
MO00F						OVER RANGE
EE00F		0.532				PEAK OFFSET
EE00F		1.132				PEAK OFFSET
EE00F		40.00				OVER STD
EE00F		-1.333				PEAK OFFSET
EE00F		0.053				PEAK OFFSET
EE00F		0.127				PEAK OFFSET
EE00F		3.540				PEAK OFFSET
EE00F		3.753				PEAK OFFSET
AL00F						OVER RANGE
CA00F		133.3				PEAK OFFSET
MO00F						OVER RANGE
EE00F	AV	0.337	SD	0.0031	CV	0.7
EE00F	AV	0.700	SD	0.0101	CV	1.4
EE00F	AV	1.233	SD	0.0133	CV	1.5
EE00F	AV	33.34	SD	3.333	CV	3.4
EE00F	AV	0.133	SD	0.0021	CV	1.1
EE00F	AV	-1.343	SD	0.0133	CV	1.6
EE00F	AV	0.051	SD	0.0001	CV	0.3
EE00F	AV	0.133	SD	0.0027	CV	2.1
EE00F	AV	0.133	SD	0.0073	CV	5.3
EE00F	AV	3.540	SD	0.0000	CV	0.0
EE00F	AV	3.753	SD	0.0000	CV	0.0
EE00F	AV	17.3	SD	0.31	CV	1.3
EE00F	AV	0.053	SD	0.0001	CV	0.1
AL00F						OVER RANGE

EE00F	AV	0.013	SD	0.0003	CV	5.3
CA00F	AV	133.3	SD	0.00	CV	0.0
CU00F	AV	0.453	SD	0.0050	CV	1.3

MONTANA BUREAU OF MINES AND GEOLOGY  
BOZEMAN, MONTANA 59701 (406)496-1101

WATER QUALITY ANALYSIS  
LAB. NO. 87Q0698

STATE MONTANA  
LATITUDE-LONGITUDE 45D30'31"N 112D43'48"W  
UTM COORDINATES Z N E  
TOPOGRAPHIC MAP EARLS GULCH 7 1/2'  
GEOLOGIC SOURCE \*  
DRAINAGE BASIN AD  
AGENCY + SAMPLER RLM \*DAL  
BOTTLE NUMBER GF2  
DATE SAMPLED 13-AUG-87  
TIME SAMPLED 11:00 HOURS  
LAB + ANALYST MENG\*MO  
DATE ANALYZED 16-SEP-87  
SAMPLE HANDLING  
METHOD SAMPLED PUMPED  
WATER USE DOMESTIC

COUNTY BEAVERHEAD  
SITE LOCATION 04S 09W 09\*AB  
MBMG SITE  
STATION ID 453031112434801  
SAMPLE SOURCE WELL  
LAND SURFACE ALTITUDE 5170. FT < 10  
SUSTAINED YIELD  
YIELD MEAS METHOD  
TOTAL DEPTH OF WELL 90. FT (R)  
SWL ABOVE (-) OR BELOW GS  
CASING DIAMETER  
CASING TYPE  
COMPLETION TYPE \*  
PERFORATED INTERVAL

SAMPLING SITE FIFIELD  
GEOLOGIC SOURCE

Drinking Water Standard

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	91.4	4.57	BICARBONATE (HCO3)	150	293.8
MAGNESIUM (MG)	30-125	1.01	CARBONATE (CO3)	20	0.0
SODIUM (NA)	20.4	0.89	CHLORIDE (CL)	250	22.0
POTASSIUM (K)	340	0.06	SULFATE (SO4)	250	45.4
IRON (FE)	0.3	0.009	NITRATE (NO3)	10	0.0
MANGANESE (MN)	0.05	0.001	FLUORIDE (F)	1.4-2.4	0.1
SILICA (SiO2)	50	0.00	PHOSPHATE TOT (AS P)		0.0

TOTAL CATIONS 8.53 TOTAL ANIONS 6.41

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.571

	MEQ/L		MEQ/L
CALCULATED DISSOLVED SOLIDS	377.53	TOTAL HARDNESS AS CaCO3	150 279.35
SUM OF DISS. CONSTITUENT	326.61	FIELD HARDNESS AS CaCO3	
FIELD CONDUCTIVITY, MICROHMS		TOTAL ALKALINITY AS CaCO3	240.9
LAB CONDUCTIVITY, MICROHMS	432.0	FIELD ALKALINITY AS CaCO3	
FIELD PH		RYZINAR STABILITY INDEX	6.82
LABORATORY PH	7.51	LANGLIER SATURATION INDEX	0.01
ADJUSTED SODIUM AD. RATIO		SODIUM ADSORPTION RATIO	0.55

PARAMETER	VALUE	PARAMETER	VALUE
ALUMINUM, DISS (UG/L AS AL)	10.0	NICKEL, DISS (UG/L AS NI)	10.0
ARSENIC, DISS (UG/L AS AS)	0.0	PHOSPHATE, TO, DISS (MG/L AS P)	50
BARIUM, DISS (UG/L AS BA)	70.0	STRONTIUM, DISS (UG/L AS SR)	370.0
CADMIUM, DISS (UG/L AS CD)	10.0	TITANIUM, DISS (UG/L AS TI)	10.0
COPPER, DISS (UG/L AS CU)	50.0	VANADIUM, DISS (UG/L AS V)	10.0
CHROMIUM, DISS (UG/L AS CR)	10.0	ZINC, DISS (UG/L AS ZN)	320.0
COBALT, DISS (UG/L AS CO)	10.0	ZIRCONIUM, DISS (UG/L AS ZR)	10.0
FLUORIDE, DISS (UG/L AS F)	10.0	CHLORIDE, TO, DISS (MG/L AS CL)	50
IRON, DISS (UG/L AS FE)	10.0	ARSENIC, DISS (UG/L AS AS)	50
MANGANESE, DISS (UG/L AS MN)	10.0		
MOLYBDENUM, DISS (UG/L AS MO)	10.0		
BROMINE, DISS (MG/L AS BR)	10.0		

EXPLANATION: MG/L = MILLIGRAMS PER LITER; UG/L = MICROGRAMS PER LITER; MEQ/L = MILLIEQUIVALENTS PER LITER; FT = FEET; M = METERS; (M) = MEASURED; (E) = ESTIMATED; (R) = REPORTED; TR = TOTAL RECOVERABLE; TOT = TOTAL; SIG = BIOLOGICALLY AVAILABLE; SIGMA INCLUDES AL, CU, SR, ZN, AND H+ IF REPORTED.

GU UA SD MI QU PW AT OTHER

OTHER AVAILABLE DATA  
OTHER FILE NUMBERS:

LAST EDIT DATE: 30-SEP-87  
PROCESSING PROGRAM: F17300 V4 (12/19/86) PRINTED: 30-SEP-87

PERCENT MEQ/L (FOR PIPER PLOT)  
CA MG NA K CL SO4 HCO3 CO3  
70.0 15.3 10.6 .9 9.7 14.6 75.5 .0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 87Q0698

OCT 0 2 87

STATE MONTANA  
 LATITUDE-LONGITUDE 45D30'31"N 112D43'45"W  
 UTM COORDINATES Z N  
 TOPOGRAPHIC MAP EARLS GULCH 7 1/2'  
 GEOLOGIC SOURCE 120SDMS\*  
 DRAINAGE BASIN AD  
 AGENCY + SAMPLER BLM \*BB  
 BOTTLE NUMBER FIFIELD  
 DATE SAMPLED 18 July 1988  
 TIME SAMPLED : HOURS  
 LAB + ANALYST MRMGKWO  
 DATE ANALYZED 27-JUL-88  
 SAMPLE HANDLING  
 METHOD SAMPLED  
 WATER USE DOMESTIC

COUNTY BEAVERHEAD  
 SITE LOCATION 04S. 09W-09-AA.  
 MBMG SITE  
 STATION ID 453031112434 1  
 SAMPLE SOURCE WELL  
 LAND SURFACE ALTITUDE 5170. FT < 10  
 SUSTAINED YIELD  
 YIELD MEAS METHOD  
 TOTAL DEPTH OF WELL 85. FT (R)  
 SWL ABOVE(-) OR BELOW GS 40. FT (R)  
 CASING DIAMETER 6 IN  
 CASING TYPE STEEL  
 COMPLETION TYPE 02\*  
 PERFORATED INTERVAL 75 TO 84 FT (R)

SAMPLING SITE FIFIELD  
 GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	90.6	4.52	BICARBONATE (HCO3)	294.8	4.8
MAGNESIUM (MG)	12.7	1.04	CARBONATE (CO3)	0.	0.
SODIUM (NA)	22.3	.97	CHLORIDE (CL)	22.8	.6
POTASSIUM (K)	2.3	.06	SULFATE (SO4)	46.1	.9
IRON (FE)	<.002		NITRATE (AS N)	.61	.0
MANGANESE (MN)	<.001		FLUORIDE (F)	.2	.0
SILICA (SIO2)	13.2		PHOSPHATE TOT (AS P)		

TOTAL CATIONS 6.60 TOTAL ANIONS 6.48

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.579

CALCULATED DISSOLVED SOLIDS	386.03	TOTAL HARDNESS AS CAC03	278.50	
SUM OF DISS. CONSTITUENT	535.61	FIELD HARDNESS AS CAC03		
FIELD CONDUCTVY, MICROMHOS		TOTAL ALKALINITY AS CAC03	241.79	
LAB CONDUCTVY, MICROMHOS	601.5	FIELD ALKALINITY AS CAC03		
FIELD PH		RYZNAR STABILITY INDEX	4.48	
LABORATORY PH	7.85	LANGLIER SATURATION INDEX		
ADJUSTED SODIUM AD. RATIO		SODIUM ADSORPTION RATIO		

PARAMETER	VALUE	PARAMETER	VALUE
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL, DISS (UG/L AS NI)	<10.
SILVER, DISS (UG/L AS AG)	<2.	PHOSPHATE, TO, DIS (MG/L-P)	<.1
BORON, DISS (UG/L AS B)	80.	STRONTIUM, DISS (UG/L-SR)	390.
CADMIUM, DISS (UG/L AS CD)	<2.	TITANIUM, DISS (UG/L AS TI)	<1.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM, DISS (UG/L AS V)	<1.
COPPER, DISS (UG/L AS CU)	2.	ZINC, DISS (UG/L AS ZN)	40.
LITHIUM, DISS (UG/L AS LI)	<2.	ZIRCONIUM, DISS (UG/L - ZR)	<4.
MOLYBDENUM, DISS (UG/L-MO)	<20.	O-PHOSPHATE, DISS (MG/L-P)	50
BROMIDE, DISS (MG/L AS BR)	<.1	ARSENIC, DISS (UG/L AS AS)	50 1.9

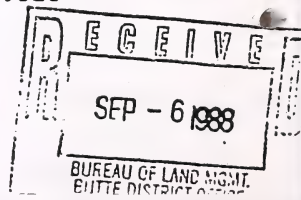
EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L MILLIEQUIVALENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE. SIGMA INCLUDES AL, CU, SR, ZN, AND H+ IF REPORTED.

OTHER AVAILABLE DATA QW WA S2 WI OW PW AT OTHER  
 OTHER FILE NUMBERS: Y 035046

LAST EDIT DATE: 02-SEP-88 BY: TP \*BCS  
 PROCESSING PROGRAM: F1730P V4 (12/19/86) PRINTED: 02-SEP-88

PERCENT MEQ/L (FOR PIPER PLOT)  
 CA MG NA K CL SO4 HCO3 CO3  
 68.5 15.8 14.7 .9 10.0 14.9 75.2 .0

NOTE: IN CORRESPONDENCE PLEASE REFER TO LAB NUMBER: 8800828





MONTANA BUREAU OF MINES AND GEOLOGY  
BUTTE, MONTANA 59701 (406) 496-4101

WATER QUALITY ANALYSIS  
LAB NO. 1000 89Q1000

1703

STATE MONTANA  
LATITUDE-LONGITUDE 45D30'21"N 112D43'02"W  
UTM COORDINATES Z N E  
TOPOGRAPHIC MAP EARLS GULCH 7 1/2'  
GEOLOGIC SOURCE \*  
DRAINAGE BASIN AC  
AGENCY + SAMPLER BLM \*  
BOTTLE NUMBER GLENTUN  
DATE SAMPLED  
TIME SAMPLED : HOURS  
LAB + ANALYST MBMG\*SH  
DATE ANALYZED 15-NOV-89  
SAMPLE HANDLING  
METHOD SAMPLED  
WATER USE

COUNTY BEAVERHEAD  
SITE LOCATION 04S 09W 09\*ACA 01  
MBMG SITE  
STATION ID 453021112430201  
SAMPLE SOURCE  
LAND SURFACE ALTITUDE 5250.0 FT < 10  
WATER FLOW RATE  
FLOW MEAS METHOD  
STAFF GAGE  
STREAM STAGE  
DEPTH TO SAMPLE  
TOTAL DEPTH OF WATER  
STREAM WIDTH

SAMPLING SITE  
DRAINAGE BASIN RUBY RIVER

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	92.4	4.61	BICARBONATE (HCO3)	288.4	4.73
MAGNESIUM (MG)	12.0	.99	CARBONATE (CO3)	0.	
SODIUM (NA)	20.2	.88	CHLORIDE (CL)	25.4	.72
POTASSIUM (K)	2.3	.06	SULFATE (SO4)	47.2	.98
IRON (FE)	<.002		NITRATE (AS N)	.68	.05
MANGANESE (MN)	<.001		FLUORIDE (F)	.33	.02
SILICA (SIO2)	36.3		PHOSPHATE TOT (AS P)		

TOTAL CATIONS 6.54 TOTAL ANIONS 6.49

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -.290

CALCULATED DISSOLVED SOLIDS	378.87	TOTAL HARDNESS AS CaCO3	280.11
SUM OF DISS. CONSTITUENT	525.21	FIELD HARDNESS AS CaCO3	
FIELD CONDUCTVY, MICROMHOS		TOTAL ALKALINITY AS CaCO3	236.53
LAB CONDUCTVY, MICROMHOS	608.4	FIELD ALKALINITY AS CaCO3	
FIELD PH		RYZNAR STABILITY INDEX	6.37
LABORATORY PH	7.95	LANGLIER SATURATION INDEX	.78
ADJUSTED SODIUM AD. RATIO		SODIUM ADSORPTION RATIO	.52

PARAMETER	VALUE
ALUMINUM, DISS (UG/L-AL)	48.
SILVER, DISS (UG/L AS AG)	<2.
BORON, DISS (UG/L AS B)	30.
CADMIUM, DISS (UG/L AS CD)	<2.
CHROMIUM, DISS (UG/L-CR)	<2.
COPPER, DISS (UG/L AS CU)	<2.
LITHIUM, DISS (UG/L AS LI)	15.
MOLYBDENUM, DISS (UG/L-MO)	<20.
BROMIDE, DISS (MG/L AS BR)	<.1
LEAD, DISS (UG/L AS PB)	<40.

PARAMETER	VALUE
NICKEL, DISS (UG/L AS NI)	<10.
PHOSPHATE, TO, DIS (MG/L-P)	<.1
STRONTIUM, DISS (UG/L-SR)	357.
TITANIUM DIS (UG/L AS TI)	3.
VANADIUM, DISS (UG/L AS V)	<1.
ZINC, DISS (UG/L AS ZN)	20.
ZIRCONIUM DIS (UG/L - ZR)	<4.
O-PHOSPHATE, DISS (MG/L-P)	<.1
ARSENIC, BIO. (UG/L AS AS)	2.1

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVALENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE. SIGMA INCLUDES AL, CU, SR, ZN, AND H+ IF REPORTED.

OTHER AVAILABLE DATA QW WA S2 WI OW PW AT OTHER  
OTHER FILE NUMBERS:

LAST EDIT DATE: 20-NOV-89 BY: TP \*BCS  
PROCESSING PROGRAM: FI730P V4 (12/20/86) PRINTED: 01-DEC-89

PERCENT MEQ/L (FOR PIPER PLOT)  
CA MG NA K CL SO4 HCO3 CO3  
70.5 15.1 13.4 .9 11.2 15.3 73.6 .0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 89Q1000

MONTANA BUREAU OF MINES AND GEOLOGY  
BUTTE, MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS  
LAB NO.: 90Q0351

1703

State: MT County: BEAVERHEAD  
Latitude-Longitude: 45D30'34"N 112D43'03"W Site Location: 04S 09W 09 ABAO 1  
Topographic Map: EARLS GULCH 7 1/2' MBMG Site: M:108186  
Geologic Source: 120SDMS\* Project Id:  
Drainage Basin: AD Station Id: 453034112430301  
Agency + Sampler: BLM \*MFB Sample Source: WELL  
Bottle number: FIFIELD Land Surface Altitude: 5158.0 FT.  
Date Sampled: 11 SEP 1990 Sustained Yield:  
Time Sampled: 16:00 Yield Meas Method:  
Lab + Analyst: MBMG\*SSH Total Depth of Well: 85.0 FT. rept.  
Date Analyzed: 27 DEC 1990 SWL above(-) or below GS:  
Sample Handling: Casing Diameter: 6.0 In.  
Method Sampled: GRAB Casing Type: STEEL  
Procedure Type: Dissolved Completion Type: TORCHCUTS  
Water Use: DOMESTIC Perforation Interval: 75.0 to 84.0 FT.

Sampling Site: FIFIELD NORMAN  
Geologic Source: SEDIMENTS (TERTIARY)

	mg/L	meq/L		mg/L	meq/L
Calcium (Ca)	89.6	4.47	Bicarbonate (HCO3)	279.	4.57
Magnesium (Mg)	11.9	0.98	Carbonate (CO3)		0.00
Sodium (Na)	20.5	0.89	Chloride (Cl)	26.6	0.75
Potassium (K)	2.63	0.07	Sulfate (SO4)	43.5	0.91
Iron (Fe)	.016	0.00	Nitrate (as N)	.25	0.02
Manganese (Mn)	<.002	0.00	Fluoride (F)	.22	0.01
Silica (SiO2)	40.4		OrthoPhosphate (as P)	<.1	0.00

Total Cations: 6.42 Total Anions: 6.26

Standard Deviation of Anion-Cation Balance (Sigma): -0.81

Calculated Dissolved Solid:	373.05	Total Hardness as CaCO3:	272.71
Sum of Diss, Constituent:	514.62	Field Hardness as CaCO3:	
Field conductivity, micromhos:		Total Alkalinity as CaCO3:	228.83
Lab conductivity, micromhos:	616.4	Field Alkalinity as CaCO3:	
Field PH:		Ryznar Stability Index:	6.30
Laboratory PH:	8.08	Langlier Saturation Index:	0.89
		Sodium Adsorption Ratio:	0.54

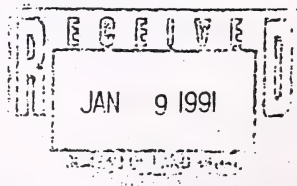
Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	
ALUMINUM, DISS (UG/L-AL)	<40.	MOLYBDENUM, DISS (UG/L-MO)	<40.
ARSENIC, DISS (UG/L AS AS)	1.4	NICKEL, DISS (UG/L AS NI)	<20.
BARIUM, DISS (UG/L AS BA)	94.	PHOSPHATE, TO, DIS (MG/L-P)	<.1
BORON, DISS (UG/L AS B)	48.	SILVER, DISS (UG/L AS AG)	<4.
BROMIDE, DISS (UG/L AS BR)	<100.	STRONTIUM, DISS (UG/L-SR)	391.
CADMIUM, DISS (UG/L AS CD)	<5.	TITANIUM DIS (UG/L AS TI)	6.
CHROMIUM, DISS (UG/L-CR)	<5.	VANADIUM, DISS (UG/L AS V)	<4.
COPPER, DISS (UG/L AS CU)	<4.	ZINC, DISS (UG/L AS ZN)	10.
LEAD, DISS (UG/L AS PB)	<50.	ZIRCONIUM DIS (UG/L - ZR)	<6.
LITHIUM, DISS (UG/L AS LI)	4.		

Explanation: mg/L = milligrams per liter, ug/L = micrograms per liter, meq/L milliequivalents per liter. FT = feet, Mt = meters, TR = total recoverable, TOT = total, BIO = biologically available. Sigma includes AL, CU, SR, ZN, and H+ if reported.

Printed: 07 JAN 91

Percent Meq/L (For Piper Plot)  
Ca Mg Na K Cl SO4 HCO3 CO3  
69.8 15.3 13.9 1.0 12.0 14.5 73.4 0.0

NOTE: In correspondence, please refer to Lab Number: 90Q0351





REPORT DATE: August 30, 1988

CLIENT: BLM-Dave Lomas

FIELD ID: Tungsten Mill Tailings

LAB NO.: X3240

DATE RECEIVED: 7-88

Ca 101,000 mg/kg

Cu 65.9 mg/kg

Fe 5,370 mg/kg

Pb <10 mg/kg

Mn 2,430 mg/kg

Mo 6.1 mg/kg

W 275 mg/kg



Report Date: 5-18-

CLIENT: BUREAU OF LAND MANAGEMENT - DAVE LOMAS

*small gray barrel on foundation*  
Field ID: GB-1

Lab No.: X2934

Date Received: 3-14-88

Alkalinity, Total 0.4 % as carbonate

Chloride 239 mg/kg

Total S 20.2 %

Carbonate Carbon 0.14 %

Total Carbon 0.14 %

Organic Carbon <0.02 %

Total Metals (Nitric - Peroxide Digestion)

Ca 316 mg/kg

Cu 4 mg/kg

Fe 635 mg/kg

Pb 11 mg/kg

Mn 18 mg/kg

Mo 8 mg/kg

W 62 mg/kg

Report Date: 5-18-88

CLIENT: BUREAU OF LAND MANAGEMENT - DAVE LOMAS

Field ID: COMPOSITE #2 (WPC-1, Crusts) *Waste pile composite & crusts from same.*  
*18 barrels*

Lab No.: COMPOSITE #2 (X2932, X2933)

Date Received: 3-14-88

Alkalinity, Total 28.2 % as carbonate

Chloride 9990 mg/kg

Total S 0.104 %

Carbonate Carbon 5.15 %

Total Carbon 5.20 %

Organic Carbon 0.05 %

Total Metals (Nitric - Peroxide Digestion)

Ca 94,600 mg/kg

Cu 72 mg/kg

Fe 6,570 mg/kg

Pb 31 mg/kg

Mn 1,760 mg/kg

Mo 987 mg/kg

W 32,300 mg/kg

Sample Results

Tyngsten Mill Site

Report Date: 5-18-88

CLIENT: BUREAU OF LAND MANAGEMENT - DAVE LOMAS

*Yellow Drum Green Drum Broken Barrel & Tailings pond drum*

Field ID: COMPOSITE #1 (YD-1, GD-1, BB-4, TPD-1)

Lab No.: COMPOSITE #1 (X2928, X2929, X2930, X2931)

Date Received: 3-14-88



Alkalinity, Total 21.9 % as carbonate

Chloride 132 mg/kg

Total S 0.0073 %

Carbonate Carbon 4.25 %

Total Carbon 4.25 %

Organic Carbon <0.02 %

Total Metals (Nitric - Peroxide Digestion).

Ca 33,400 mg/kg

Cu 66 mg/kg

Fe 25,200 mg/kg

Pb 61 mg/kg

Mn 2,530 mg/kg

Mo 34 mg/kg

W 251 mg/kg

APPENDIX 7

MSE CHEMICAL ANALYSIS

HYDROMETRICS  
SAMPLE CODES - SOIL SAMPLES

<u>Code</u>	<u>Date</u>	<u>Site</u>	<u>Depth</u>
GT-8905-01	5/30/89	Pond #1 Silty Comp.	0" - 6"
GT-8905-02	5/30/89	Pond #1 Silty Comp.	6" - 18"
GT-8905-03	5/30/89	Pond #1 Sandy Comp.	0" - 6"
GT-8905-04	5/30/89	Pond #1 Sandy Comp.	6" - 18"
GT-8905-05	5/30/89	Pond #2 Silty Comp.	0" - 6"
GT-8905-06	5/30/89	Pond #2 Silty Comp.	6" - 18"
GT-8905-07	5/30/89	Pond #2 Sandy Comp.	0" - 6"
GT-8905-08	5/30/89	Pond #2 Sandy Comp.	6" - 18"
GT-8905-0			
GT-8905-9	5/30/89	Dike Crest	0" - 12"

01 to 08 are composite samples

Pond #1 is largest pond to be reclaimed

Pond #2 is pond to be reclaimed north of Pond #1

**ENERGY LABORATORIES, INC.**

P.O. BOX 30916 • 1107 SOUTH BROADWAY • BILLINGS, MT 59107-0916 • PHONE (406) 252-6325  
800-873-5227

**LABORATORY REPORT**

TO: Hydrometrics  
ADDRESS: 2727 Airport Road  
Helena, MT 59601  
Attn: Dan March

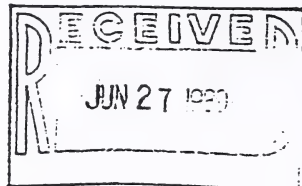
LAB NO.: 89-8826  
DATE: 06/26/89 dya

SOIL ANALYSIS

Sampled 05/30/89  
Submitted 06/06/89

page 1

LAB NO.  
89-8826



Sample Number	1	2	3	4
Location	GT-8905-01	GT-8905-02	GT-8905-03	GT-8905-04
pH, s.u.	8.6	8.5	8.3	8.4
Cond., mmhos/cm	3.39	0.60	0.34	0.27
Calcium, meq/l	3.12	1.35	1.70	1.56
Magnesium, meq/l	2.81	0.98	0.81	0.67
Sodium, meq/l	29.0	4.07	0.34	0.25
CLL	16.8	3.77	0.30	0.24
Sand %	50	64	90	90
Silt %	37	30	8	6
Clay %	13	6	2	4
Texture	L	SL	S	S
Nitrate as N, ppm	8.4	<1.0	<1.0	<1.0
Phosphorus, ppm	4.0	2.0	2.0	2.2
Potassium, ppm	135	60.4	24.4	27.7



**LABORATORY REPORT**

TO: Hydrometrics  
ADDRESS: 2727 Airport Road  
Helena, MT 59601  
Attn: Dan March

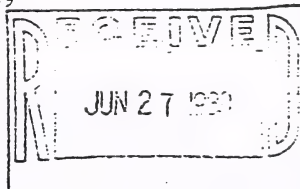
LAB NO.: 89-8826  
DATE: 06/26/89 dya

SOIL ANALYSIS

Sampled 05/30/89  
Submitted 06/06/89

page 2

LAB NO.  
89-8826



Sample Number	5	6	7	8
Location	GT-8905-05	GT-8905-06	GT-8905-07	GT-8905-08
pH, s.u.	9.1	9.2	8.4	8.4
d., mmhos/cm	0.52	5.79	0.42	0.32
Calcium, meq/l	1.10	8.41	2.09	1.75
Magnesium, meq/l	1.51	8.59	1.07	0.59
dium, meq/l	1.50	45.7	0.73	0.43
SAR	1.31	15.7	0.58	0.40
Sand %	40	34	92	90
Silt %	54	63	6	6
Clay %	6	3	2	4
Texture	SiL	SiL	S	S
Nitrate as N, ppm	<1.0	<1.0	<1.0	<1.0
Phosphorus, ppm	2.0	2.2	1.6	1.8
Potassium, ppm	121	85.5	28.0	17.1

REPORT DATE: December 7, 1993

CLIENT: BLM - Glen Millsite

FIELD ID: S-1

LAB NO: S6198

DATE SAMPLED: 11-19-93

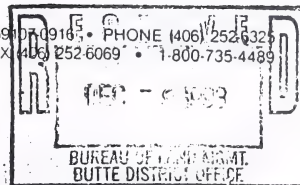
DATE RECEIVED: 11-19-93

Total Petroleum Hydrocarbon 181 mg/Kg

TPH by IR 418.1  
Method 418.1

  
Review



**LABORATORY REPORT**

**TO:** Mike Browne  
**ADDRESS:** Bureau of Land Management  
P.O. Box 3388  
Butte, MT 59702

**LAB NO.:** 93-55903  
**DATE:** 12/07/93 crp

**SOIL ANALYSIS**

Sampled 11/19/93 @ 1535  
Submitted 11/23/93

<u>Lab No.</u>	<u>Sample Identification</u>	<u>Date Analyzed</u>	<u>µg/g (ppm)</u>			
			<u>Gasoline Range Organics</u>	<u>Gasoline Range Organics as Gasoline</u>	<u>Total Purgeable Hydrocarbons</u>	<u>*Surrogate % Recovery</u>
93-55903	Tailings, S-1	12/03/93	<2.0	<2.0	12	103
Blank	Method Blank	12/03/93	<2.0	<2.0	<2.0	101

\*Trifluorotoluene surrogate added to the sample for quality assurance purposes.

**NOTES:** **Gasoline Range Organics** are defined as all hydrocarbons eluting between 2-Methylpentane and 1,2,4-Trimethylbenzene.

**Gasoline Range Organics as Gasoline** are defined by the analyst as the portion of the chromatogram between 2-Methylpentane and 1,2,4-Trimethylbenzene that resembles gasoline.

**Total Purgeable Hydrocarbons** are defined as the total hydrocarbon response regardless of elution time. This value is equivalent to method 8015 modified TPH as Gasoline.

**LABORATORY REPORT**

TO: Eric Martin  
ADDRESS: MT Dept. of Health & Environmental Sciences  
Water Quality Bureau  
Cogswell Building  
Helena, MT 59620

LAB NO.: 93-55943  
DATE: 12/15/93 ag

Page 1 of 2

**RECEIVED**
**SOIL ANALYSIS**

Glen Mill Site  
Sampled 11/19/93 @ 1535  
Submitted 11/23/93  
Extracted 11/24/93  
Analyzed 12/03/93

DEC 29 1993  
MONT. DEPT. OF HEALTH & ENV. SCIENCES  
WATER QUALITY BUREAU

Analysis Method: EPA Method 8270  
Extraction Method: EPA Method 3550  
Amount Extracted: 30 g  
Final Extract Volume: 1 ml

**TARGET COMPOUNDS**

REVIEW	INITIAL	DATE
DEC 17 1993		
ENTERED	INITIAL	DATE

Cas No.	Compound	Concentration Units, $\mu\text{g/g}$	Result Qualifier
83-32-9	Acenaphthene	<0.33	U
208-96-8	Acenaphthylene	<0.33	U
120-12-7	Anthracene	>0.33	U
103-33-3	Azobenzene	<0.33	U
92-87-5	Benzidine	<0.67	U
56-55-3	Benzo(a)Anthracene	<0.33	U
205-99-2	Benzo(b)Fluoranthene	<0.33	U
207-08-9	Benzo(k)Fluoranthene	<0.33	U
191-24-2	Benzo(g,h,i)perylene	<0.33	U
50-32-8	Benzo(a)pyrene	<0.33	U
101-55-3	4-Bromophenyl-phenylether	<0.33	U
85-68-7	Butylbenzylphthalate	<0.33	U
59-50-7	4-Chloro-3-Methylphenol	<0.33	U
111-91-1	bis(-2-Chloroethoxy)Methane	<0.33	U
111-44-4	bis(-2-Chloroethyl)Ether	<0.33	U
108-60-1	bis(2-Chloroisopropyl)ether	<0.33	U
91-58-7	2-Chloronaphthalene	<0.33	U
95-57-8	2-Chlorophenol	<0.33	U
106-48-9	4-Chlorophenol	<0.33	U
7005-72-3	4-Chlorophenyl-phenylether	<0.33	U
218-01-9	Chrysene	<0.33	U
53-70-3	Dibenzo(a,h)anthracene	<0.33	U
95-50-1	1,2-Dichlorobenzene	<0.33	U
541-73-1	1,3-Dichlorobenzene	<0.33	U
106-46-7	1,4-Dichlorobenzene	<0.33	U
91-94-1	3,3'-Dichlorobenzidine	<0.67	U
120-83-2	2,4-Dichlorophenol	<0.33	U
84-66-2	Diethylphthalate	<0.33	U
131-11-3	Dimethyl Phthalate	<0.33	U
105-67-9	2,4-Dimethylphenol	<0.33	U
84-74-2	Di-n-Butylphthalate	<0.33	U
534-52-1	4,6-Dinitro-2-methylphenol	<1.70	U
51-28-5	2,4-Dinitrophenol	<1.70	U
121-14-2	2,4-Dinitrotoluene	<0.33	U
606-20-2	2,6-Dinitrotoluene	<0.33	U
117-84-0	Di-n-octyl Phthalate	<0.33	U
117-81-7	bis(2-ethylhexyl)Phthalate	<0.33	U
206-44-0	Fluoranthene	<0.33	U
86-73-7	Fluorene	<0.33	U
118-74-1	Hexachlorobenzene	<0.33	U
57-68-3	Hexachlorobutadiene	<0.33	U
77-47-4	Hexachlorocyclopentadiene	<0.33	U

Eric Martin  
MT Dept. of Health & Environmental Sciences

93-55943

Page 2 of 2

RECEIVED  
DEC 29 1993  
MONT. DEPT. OF HEALTH & ENV. SCIENCES  
WATER QUALITY BUREAU

REVIEW	INITIAL	DATE
	DEC 17 1993	
ENTERED	INITIAL	DATE

TARGET COMPOUNDS

<u>Cas No.</u>	<u>Compound</u>	<u>Concentration</u> <u>Units, <math>\mu\text{g/g}</math></u>	<u>Result</u> <u>Qualifier</u>
67-72-1	Hexachloroethane	<0.33	U
193-39-5	Indeno(1 2 3-cd)pyrene	<0.33	U
78-59-1	Isophorone	<0.33	U
90-12-0	1-Methylnaphthalene	<0.33	U
91-57-6	2-Methylnaphthalene	<0.33	U
95-48-7	2-Methylphenol	<0.33	U
106445/108394	4Methylphenol/3Methylphenol	<0.33	U
91-20-3	Naphthalene	<0.33	U
98-95-3	Nitrobenzene	<0.33	U
88-75-5	2-Nitrophenol	<0.33	U
100-02-7	4-Nitrophenol	<1.70	U
62-75-9	N-Nitrosodimethylamine	<0.33	U
621-64-7	N-nitroso-Di-n-propylamine	<0.33	U
86-30-6	N-nitrosodiphenylamine	<0.33	U
87-86-5	Pentachlorophenol	<1.70	U
85-01-8	Phenanthrene	<0.33	U
108-95-2	Phenol	<0.33	U
129-00-0	Pyrene	<0.33	U
110-86-1	Pyridine	<0.67	U
120-82-1	1 2 4-Trichlorobenzene	<0.33	U
95-95-4	2 4 5-Trichlorophenol	<0.33	U
88-06-2	2 4 6-Trichlorophenol	<0.33	U

SURROGATE RECOVERY REPORT

<u>Surrogate Compound</u>	<u>Amount</u> <u>Added, ng</u>	<u>Amount</u> <u>Measured, ng</u>	<u>% Recovered</u>	<u>QC Limit,</u> <u>% Recovery</u>
2-Fluorophenol	200	154	77	25-121
Phenol-d5	200	240	120	24-113
Nitrobenzene-d5	100	98	98	23-120
2-Fluorobiphenyl	100	76	76	30-115
2,4,6-Tribromophenol	200	210	105	19-122
Terphenyl-d14	100	89	89	18-137

U = Indicates compound was analyzed for but not detected.

**LABORATORY REPORT**

TO: Eric Martin  
ADDRESS: MT Dept. of Health & Env. Sciences  
Water Quality Bureau  
Cogswell Building  
Helena, MT 59620

LAB NO.: 93-55943  
DATE: 12/15/93 ag

Page 1 of 2

**RECEIVED****DEC 29 1993**MONT. DEPT. OF HEALTH & ENV. SCIENCES  
WATER QUALITY BUREAUSOIL ANALYSIS

Glen Mill Site  
Sampled 11/19/93 @ 1535  
Submitted 11/23/93  
Analyzed 12/03/93

REVIEW	
INITIAL	DATE
DEC 17 1993	
ENTERED	
INITIAL	DATE

Analysis Method: EPA Method 8260  
Extraction Method: EPA Method 5030

*Purgeable Organics*  
*E.P. <160°*

**TARGET COMPOUNDS**

<u>Cas No.</u>	<u>Compound</u>	<u>Concentration</u> <u>Units, µg/g</u>	<u>Qualifier</u> <u>Code</u>
71-43-2	Benzene	<0.20	U
108-86-1	Bromobenzene	<0.20	U
74-97-5	Bromochloromethane	<0.20	U
75-27-4	Bromodichloromethane	<0.20	U
75-25-2	Bromoform	<0.20	U
74-83-9	Bromomethane	0.22	B
56-23-5	Carbon Tetrachloride	<0.20	U
108-90-7	Chlorobenzene	<0.20	U
75-00-3	Chloroethane	<0.20	U
110-75-8	2-Chloroethylvinyl Ether	<0.20	U
67-66-3	Chloroform	<0.20	U
74-87-3	Chloromethane	<0.20	U
95-49-8	2-Chlorotoluene	<0.20	U
106-43-4	4-Chlorotoluene	<0.20	U
124-48-1	Dibromochloromethane	<0.20	U
106-93-4	1,2-Dibromoethane	<0.20	U
74-95-3	Dibromomethane	<0.20	U
95-50-1	1,2-Dichlorobenzene	<0.20	U
541-73-1	1,3-Dichlorobenzene	<0.20	U
106-46-7	1,4-Dichlorobenzene	<0.20	U
75-71-8	Dichlorodifluoromethane	<0.20	U
75-34-3	1,1-Dichloroethane	<0.20	U
107-06-2	1,2-Dichloroethane	<0.20	U
75-35-4	1,1-Dichloroethene	<0.20	U
156-59-2	cis-1,2-Dichloroethene	<0.20	U
156-60-5	trans-1,2-Dichloroethene	<0.20	U
78-87-5	1,2-Dichloropropane	<0.20	U
142-28-9	1,3-Dichloropropane	<0.20	U
594-20-7	2,2-Dichloropropane	<0.20	U
563-58-6	1,1-Dichloropropene	<0.20	U
10061-01-5	cis-1,3-Dichloropropene	<0.20	U
10061-02-6	trans-1,3-Dichloropropene	<0.20	U
100-41-4	Ethyl Benzene	<0.20	U
78-93-3	Methyl Ethyl Ketone	<4.00	U
75-09-2	Methylene Chloride	<0.20	U
100-42-5	Styrene	<0.20	U
630-20-6	1,1,1,2-Tetrachloroethane	<0.20	U



Eric Martin  
MT Dept. of Health & Env. Sciences

Page 2 of 2

93-55943

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DEC 29 1993

MONT. DEPT. OF HEALTH & ENV. SCIENCES  
WATER QUALITY BUREAU

REVIEW	INITIAL	DATE
DEC 17 1993		
ENTERED	INITIAL	DATE

TARGET COMPOUNDS

Cas No.	Compound	Concentration Units, $\mu\text{g/g}$	Qualifier Code
79-34-5	1,1,2,2-Tetrachloroethane	<0.20	U
127-18-4	Tetrachloroethene	<0.20	U
108-88-3	Toluene	<0.20	U
71-55-6	1,1,1-Trichloroethane	<0.20	U
79-00-5	1,1,2-Trichloroethane	<0.20	U
79-01-6	Trichloroethene	<0.20	U
75-69-4	Trichlorofluoromethane	<0.20	U
96-18-4	1,2,3-Trichloropropane	<0.20	U
75-01-4	Vinyl Chloride	<0.20	U
108-38-3	m + p Xylenes	<0.20	U
95-47-6	o-Xylene	<0.20	U

SURROGATE RECOVERY REPORT

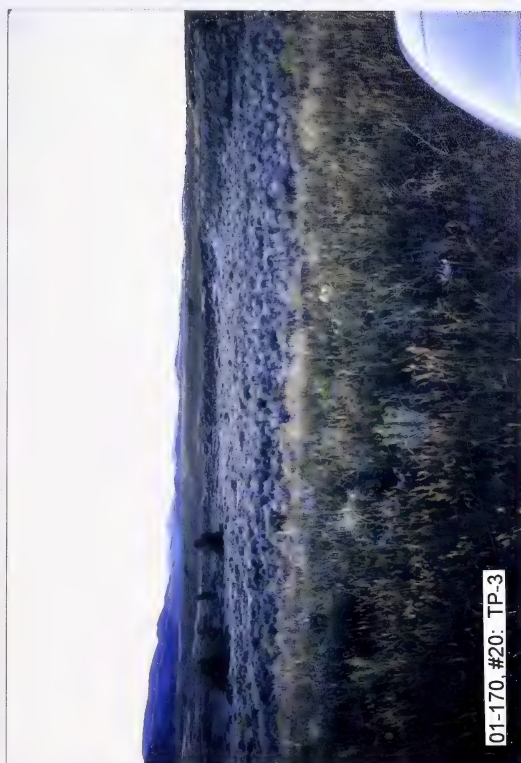
Surrogate Compound	Amount Added, ng	Amount Recovered, ng	% Recovered	QC Limits, % Recovery
1,2-Dichloroethane-d4	250	260	104	70-120
Toluene d8	250	260	104	75-120
p-Bromofluorobenzene	250	260	104	75-120

U = Indicates compound was analyzed for but not detected.

B = The analyte was found in the associated blank as well as the sample.

NOTE: Bromomethane was found in both the associated blank and sample and appeared to be attributable to the calibration curve that was analyzed immediately before the blank and sample were analyzed.













MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: CLARA PA#: 01-262

Date: August 13, 1993 Time: 1350-1500

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Tuesday, Pioneer  
Belanger, Pioneer

Visitors: None

Weather/Seasonality Observations: Overcast; warm; cool, wet  
spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #10: Adit GW-1, WR-  
2, and shaft; #11: WR-1; #12: WR-3 and SW-2 upgradient seep.  
Video Tape No. 5

General Comments/Observations (not covered specifically in attached Inventory Forms):  
Aspen have large growths (tree cancer).

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Isolate waste  
material from surface water; grade, amend, and revegetate. Study  
whether seep from adit requires treatment.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): CLARA PA#: 01-262

Legal Description: T 3S ; R 14W ; Sec. 18 , NE1/4 NW1/4 1/4

County: BEAVERHEAD Mining District: WISDOM

Latitude: N 45° 34' 43" Longitude: W 113° 22' 38"

Primary Drainage Basin and Code: Steel Creek/10020004

Secondary Drainage Basin: Dry Gulch

USGS Quadrangle map name(s): Highland Ranch

Mine Type/Commodities: Hardrock/Unknown

Activity Status: Active      , Inactive/Exploration      , Abandoned X .

Ownership status: Known YX N ; private/public? Private

Owner, Agent, or Contact (Include address and phone when available): John and Phyllis Erb, 555 Skyline Drive, Dillon, MT 59725. (406) 683-5568.

Relationship to other mines/sites in the area/district: No immediate mines in the area.

Regulatory Status (Activity by other agencies)? Hardrock permits?       
Past Reclamation Activities? N/A

General site features: Elevation 6460' , Slope 15° ,  
Aspect Northwest

Land use: Mining      , Recreational      , Residential      , Urban      ,  
Agricultural X , Other (Specify)     

Area of disturbed/unvegetated lands? 1.5 acres.  
Dimensions:     

Predominant vegetation types: Douglas fir, Lodgepole pine, aspen, Buffalo berry, rose.

Access: roads - good      , poor      , 4wd      , trail X .  
Other logistical considerations (proximity to other sites). Hike from above the site down Dry Gulch approx. 0.25 mile.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are 7 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Site lies on the north side of an unnamed  
tributary to Dry Gulch. Tributary is intermittent and flows  
southwest away from the site to confluence with Dry Gulch approx.  
1,000 feet below the site.

Mining/milling history, ore type/tenor, host rock, gangue: No  
information available.

Mine Operation?

Shafts - Yes X, No    , # 1, Comment Caved

Adits - Yes X, No    , # 3, Comment Caved

Pits - Yes    , No X, #    , Comment    

Placers - Yes    , No X, #    , Comment    

Other - Yes    , No X, #    , Comment    

Mill Operation? Yes    , No X. If yes answer the next three  
questions:

Period(s) of Operation: N/A

Origin of Ore Milled - Custom Mill     Dedicated Mill    ; Number and  
names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
N/A

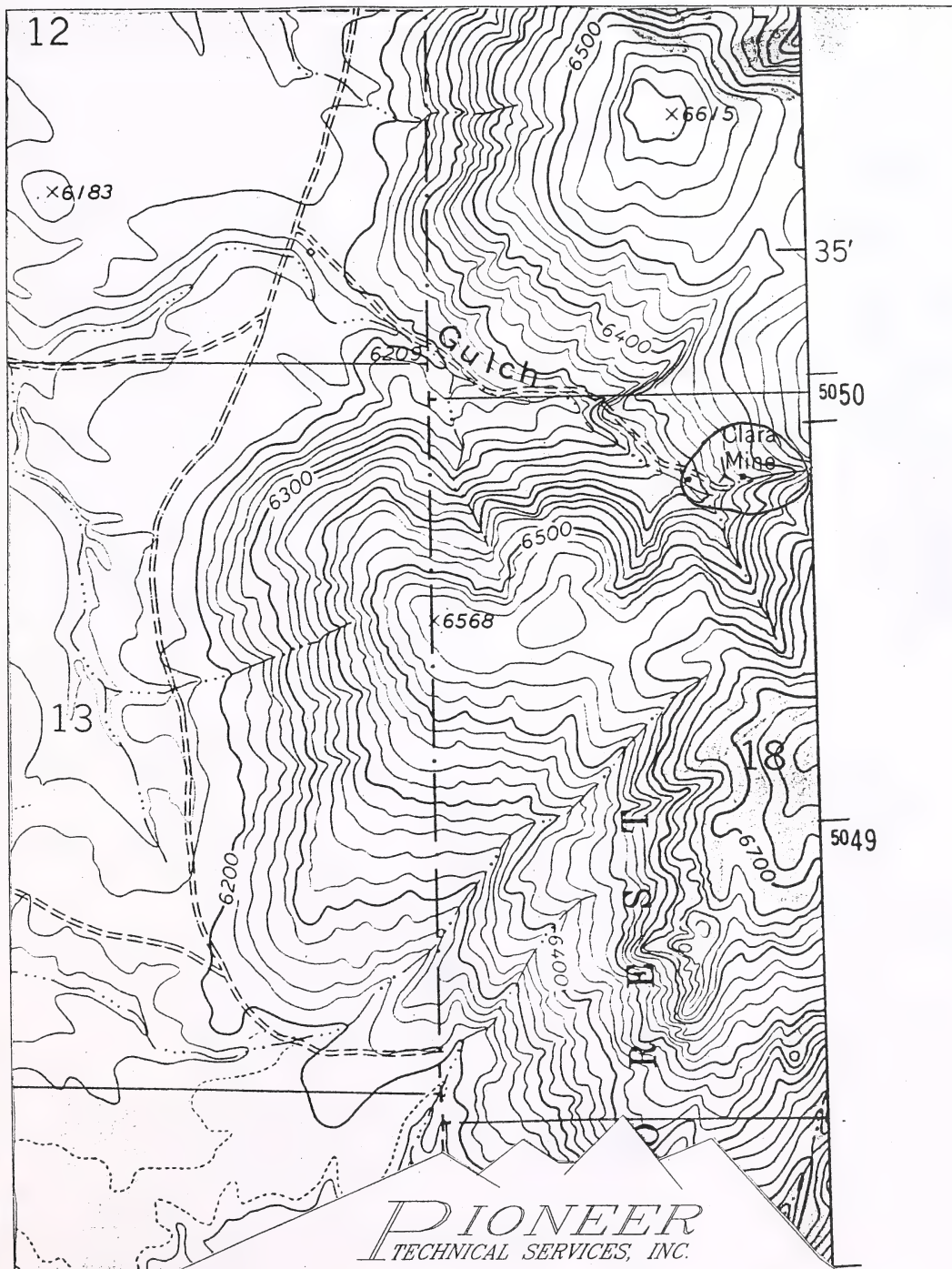
Montana Bureau of Mines and Geology  
Water Well Log Data

11/10/1993

Well No.	Location	Depth	Yield	Static Water Level
107680	03S 15W 08 CC	125.0	20.0	0.00
M:107682	03S 15W 19 CCC	72.0	0.0	65.00
M:120020	03S 15W 19 CCC	46.0	25.0	8.00
M:107683	03S 15W 20 CA	102.0	0.0	5.00
M:107684	03S 15W 20 CC	31.0	40.0	2.00
M:107685	03S 15W 20 DB	38.0	15.0	0.00
M:107686	03S 15W 20 DB	93.0	0.0	4.00







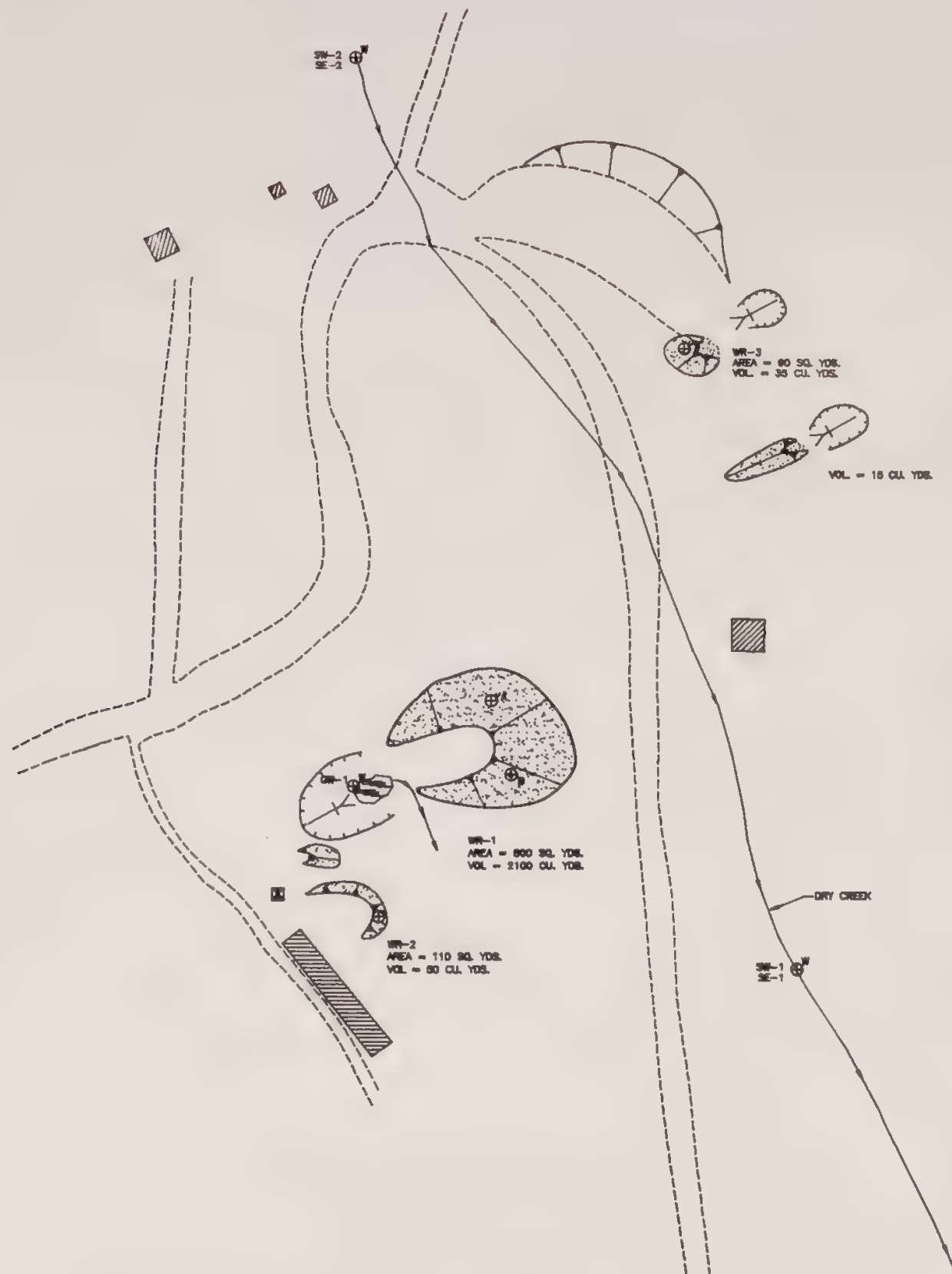
*PIONEER*  
TECHNICAL SERVICES, INC.

CLARA, P.A. NO. 01-262

T03S, R15W, SECTION 18

SCALE: 1" = 1000'





SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
---	CULVERT	---	OPEN ADIT
*	LIGHT (LIGHT POLE)	---	COLLAPSED ADIT
o	UTILITY POLE	---	OPEN SHAFT
•	DECIDUOUS TREE	---	COLLAPSED SHAFT
•	CONIFEROUS TREE	---	EXCAVATION
---	WOOD FENCE	---	WASTE ROCK DUMP
---	WIRE FENCE	---	COLLAPSED TIMBERS
---	BUILDING	---	RAILS
o	BARRIER POST	---	SOIL SAMPLE
>	GATE	---	JOFF SAMPLE
---	EDGE OF ASPHALT	---	WATER SAMPLE
---	EDGE OF GRAVEL	---	GROUND AND SURFACE
▲	SLOPE DIRECTION	---	DRAINAGE
---	TALKING POND	---	WATER WELL
		---	PONDED WATER
		---	VEGETATED WET LANDS



NOT TO SCALE

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

CLARA MINE PA# 01-262  
WISDOM DISTRICT BEAVERHEAD COUNTY

PIONEER  
ENGINEERING CONSULTANTS

TDSH

DRAWN: DATE 11/30/83  
DESIGNED: JOB NO. 83-17  
APPROVED: F.B. NO.

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A





**SAMPLERS:** Belanger

[illegible]

\*D-Direct reading (Kelway Meter); S-Saturated Paste (Orion Meter)

**Comments or deviations from SOPs:** 01-262-WR-1 is composite of WR-1A and -1B, WR-2, and WR-3.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map.

Flowing adits: Yes X, No     , Number: 1 Identification: Adit associated with WR-3

Filled shafts: Yes     , No X, Number:      Identification:     

Seeps/Springs: Yes X, No     , Number: 1 Identification: Dry Gulch source is a spring upgradient of the site.

Groundwater wells within 4 miles?: Yes X, No     ;  
Number of well logs: 99

Distance to nearest well used for drinking? 2 miles to nearest ranch house on topographic map. Well logs may be stock watering wells on BLM and state lease land.

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite     , Probable     , Possible X, Unlikely     .

Adit discharge flows over a portion of WR-1 and waste rock dumps; therefore, there is a slight possibility of groundwater contamination.

Other observations/notes: N/A

**SAMPLERS:** Belanger

[illegible]

WOM: Estimated (E) or Measured (M) from edit, sheet, snap or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): Unnamed tributary which starts 1/2 way down Dry Gulch and flows through the site.

Dry streambeds: Yes X, No     , Name(s): Part of Dry Gulch

Other surface water: Yes     , No X, Name(s)/Description:     

Waste materials within any floodplain: Yes X, No      Source ID(s): WR-3

Approximate Flood frequency?      1 yr, X 10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)?     

High Flow: 0.5 cfs, Average Flow: 0.1 cfs

Distance between waste source(s) and nearest surface water body (ft)? 25 feet

Surface water draining onto or through waste sources: Yes X, No     , Describe: Discharge from the adit associated with WR-1 flows over the dump before seeping back into the ground.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Stock watering, irrigation

Observed erosional/sedimentation/stream turbidity problems? Yes     , No X, Distance downstream (ft)?      Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): None observed during this investigation.



**SAMPLERS:** Tuesday

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? 5 acres

Wetlands present: Yes     , No X, Describe:                     

Carbonate rocks/soils: Yes     , No X, Describe:                     

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10     ; 10-30     ; 30-100 X;  
100-300     ; 300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or  
greater     ; Comments                     

Nearest residence(ft or miles)? 2 miles

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



SAMPLERS: Belanger

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X, Describe: \_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_; 300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_; Comments None

Evidence of recreational use on site: Yes\_\_\_\_, No X, Describe: \_\_\_\_\_

Accessibility - Fences, warning signs, closed roads? Unrestricted

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment_____
Wilderness Area -	Yes____, No <u>X</u> , Comment_____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment_____
Bat Habitat -	Yes____, No <u>X</u> , Comment_____

Primary Drainage X; Secondary Drainage\_\_\_\_; No Information\_\_\_\_:

Riparian Habitat Quality -	High <u>X</u> , Medium____, Low____
Wetlands Frontage -	High <u>X</u> , Medium____, Low____
Fisheries Habitat and Species Classification -	<u>1</u>
Sport Fishery Classification -	<u>3</u>

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No\_\_\_\_, Number 1, types and locations: Collapsed shaft

Hazardous structures: Yes X, No\_\_\_\_, Number 2, types and locations: Structure near shaft and cabin

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain: \_\_\_\_\_

## Bibliography

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for the Clara mine, Prepared by Chen-Northern, August 22, 1989.

USGS, Topographic Map, Highland Ranch, Montana, 7 1/2 minute Quadrangle, 1966.



LABORATORY ANALYTICAL DATA

CLARA  
PA NO. 01-262





Clara PA# 01-262  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 08/13/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
01-262-SE-1	7 U	173	1 J	4.5	5.8	8.3	11800	0.061 U	249	4 U	12 U	9 U	49	NR
01-262-SE-2	8 U	48.5	0.8 U	3.1 U	2.6	2.6	6390	0.045 U	140	4 U	14	10 U	40	NR
01-262-WR-1	14 U	622	6.1 J	6.6	4.1 U	86.8	39300	1.1	1990	8	145	18 U	995	NR
BACKGROUND	6	178	0.5 U	4.5	4	3.4	11400	0.027 U	880	4	10	6 U	62	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL POTENTIAL		SULFUR ACID BASE POTENTIAL		PYRITIC ACID BASE POTENTIAL		ORGANIC SULFUR		PYRITIC ACID BASE POTENTIAL	
	%	t/1000	%	t/1000	%	t/1000	%	t/1000	%	t/1000	%	t/1000
01-262-WR-1DUP	0.01	0.31	33.0	32.7	0.01	0.01	0.01	0.00	0.01	0.00	0.00	33.0
01-262-WR-1	<0.01	0.00	32.4	32.4	<0.01	<0.01	<0.01	0.00	<0.01	0.00	0.00	32.4

WATER MATRIX ANALYSES

Metals in Water  
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO <sub>3</sub> /L)
01-262-GW-1	2.64	153	3.27	9.7 U	6.83 U	7.7 J	162	0.160	87.7	12.7 U	2.62	30.7 U	40.7	84
01-262-SW-1	9.37	140	2.57 U	9.7 U	6.83 U	17.2 J	3100	0.250	434	165	2.32	30.7 U	204	122
01-262-SW-2	2.15	49	2.57 U	9.7 U	6.83 U	1.55 U	203	0.180	6.97	12.7 U	0.72 U	30.7 U	7.57 U	57.4

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry  
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO <sub>3</sub> /NO <sub>2</sub> -N	CYANIDE
01-262-GW-1	209	5.0	23	< 0.05	NR
01-262-SW-1	330	10.0	15	< 0.05	NR
01-262-SW-2	181	8.0	22	< 0.05	NR

LEGEND

SE1 - Downgradient of site on Dry Gulch.  
SE2 - Upgradient of site in Dry Gulch.  
WR1 - Composite of subsamples WR1A, 1B, 2, and 3.  
BACKGROUND - From the Clara Mine (01-262-SS-1).  
WR1DUP - Duplicate of the 01-262-WR-1 sample.

GW1 - Discharge from adit associated with waste rock dump 3.  
SW1 - Same as sample SE1.  
SW2 - Same as sample SE2.



XRF ANALYSIS RESULTS

CLARA  
PA NO. 01-262



Mine Name: Clara PA# 01-262  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHI	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-262-SS-1		18348 \$	13125 \$	2369 \$		1215 \$	18998 \$			122 \$	12 \$	394 \$
01-262-WR1-A		25285.4	14403.9	1310.57		528.271 *	19765.6			506.095		107.809
01-262-WR1-B		40417.6	7335.59	1386.15		976.748 *	23104.6			716.195		64.7762
01-262-WR-1-COMP		28043.9	10593.1	1354.42		1597.21	31552.6			537.033		132.776
01-262-WR-2		21559.6	12269.9	1531.02		724.049 *	21581.4			686.21		129.461
01-262-WR-3		21213.4	9663.46	1205.89		3505.12	55120.2			280.478		252.406
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-262-SS-1	218 \$											
01-262-WR1-A	168.485					56 \$		889 \$	151 \$	15 \$	17 \$	
01-262-WR1-B	190.228				171.233			591.255		13.3381 *	10.7471 *	
01-262-WR-1-COMP	197.795			51.6391 *	275.061			779.456		15.7137 *	12.044 *	
01-262-WR-2	191.706			65.0132	191.011			782.48			12.0079 *	
01-262-WR-3	217.119				175.081			636.649			7.6859 *	
					185.887			733.148		10.7158 *	7.48283 *	

\* - Estimated Quantity  
\$ - Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

CLARA  
PA NO. 01-262



# **AIMSS SCORESHEET**

SITE NAME:

CLARA

PA NUMBER:

01-262

LINE NO.		GROUNDWATER PATHWAY	
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	20
3B		GW DEPTH	20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
6		WELLS - 1 MI. x 2.5	0.267
7	GW - TARGETS	WELLS - 1 TO 4 MI	17.5
8		NEAREST WELL	92
9		TARGETS SCORE	LINES 6 + 7 + 8
10		GROUNDWATER SCORE	LINES 4 x 5 x 9

		SURFACE WATER PATHWAY	
11		OBSERVED RELEASE	300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES	50
13A		CONTAINMENT	20
13B		DISTANCE TO SW	10
13C		POTENTIAL TO RELEASE	LINES 13A x 13B
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
16		DRINKING WATER POP'N	0.312
17		IMPACTED DRAINAGE	0
18	SW - TARGETS	WETLANDS	0
19		FISHERY	20
20		RECREATION	0
21		IRRIGATION/STOCK	2
22		T & E SPECIES HABITAT	0
23		TARGETS SCORE	SUM LINES 16 - 22
24		SURFACE WATER SCORE	LINES 14 x 15 x 23

		AIR PATHWAY	
25		OBSERVED RELEASE	0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT	1
26B		DISTANCE TO POPULATION	5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B
27		LIKELIHOOD SCORE	LINES 25 + 26C
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
29		POPULATION - 4 MILES	0.002
30		NEAREST RESIDENCE	30
31	AIR - TARGETS	WETLANDS	0
32		PARKS / WILDERNESS	10
33		T & E SPECIES HABITAT	0
34		TARGETS SCORE	SUM LINES 29 - 33
35		AIR PATHWAY SCORE	LINES 27 x 28 x 34

		DIRECT CONTACT PATHWAY	
36		OBSERVED EXPOSURE	0
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY	20
37B		DISTANCE TO POPULATION	5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B
38		LIKELIHOOD SCORE	LINES 36 + 37C
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
40		POPULATION - 1 MILE	0.002
41	DIRECT CONTACT TARGETS	NEAREST RESIDENCE	0
42		RECREATIONAL USE	0
43		TARGETS SCORE	SUM LINES 40 - 42
44		DIRECT CONTACT SCORE	LINES 38 x 39 x 43

45 TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE  
(LINES 10 + 24 + 35 + 44) / 100,000

0.15

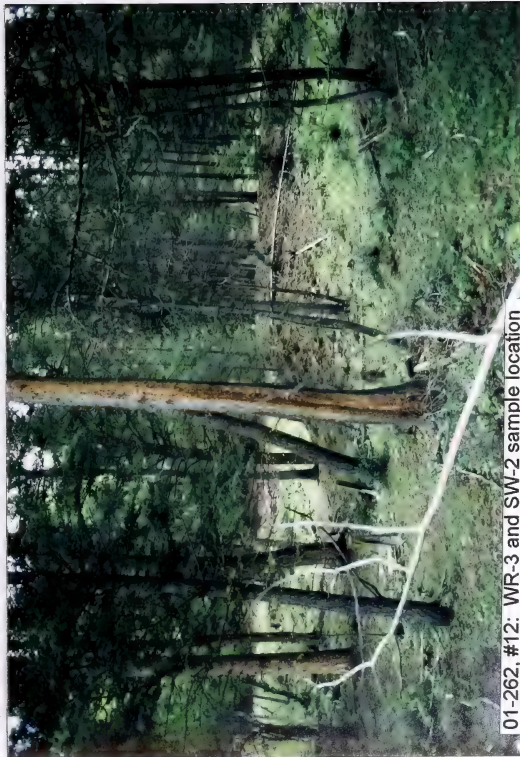
LINE NO.			SITE NAME:	CLARA
			PA NUMBER:	01-262
1	<b>SITE SAFETY</b>			
2	THREAT	ACCESSIBILITY		20
3	HAZARDS	OPEN SHAFTS	100 EA.	100
4		OPEN ADITS	50 EA.	0
5		UNSTAB. HIWALLS / PITS	75 EA.	0
6		HAZ. STRUCTURES	40 EA.	80
7		EXPLOSIVES		0
8		HAZ. MATERIALS		0
9		HAZARDS SCORE	SUM LINES 2 - 7	180
10	TARGETS	POPULATION - 1 MILE		0
11		NEAREST RESIDENCE		0
12		RECREATIONAL USE		0
13		TARGETS SCORE	SUM LINES 9 - 11	0
	<b>SITE SAFETY SCORE</b>		(LINES 1 x 8 x 12) / 1,000	<b>0.00</b>



01-262, #10: Adit, GW-1 sample location and WR-2 and shaft



01-262, #11: WR-1



01-262, #12: WR-3 and SW-2 sample location





MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: MARTIN PA#: 01-270

Date: September 9, 1993 Time: 1630-1830

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Tuesday, Pioneer

Visitors: Tim Pfahler, MDSL Helicopter Pilot

Weather/Seasonality Observations: Calm; clear; approx. 60°F; cool,  
wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #26: WR-3; #27: GW-1  
and Adit #1; #28: WR-1 and WR-2. Video Tape No. 6

General Comments/Observations (not covered specifically in attached Inventory Forms):  
N/A

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Remove waste  
material from the drainages, amend, and revegetate.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): MARTIN PA#: 01-270

Legal Description: T 3S ; R 13W ; Sec. 19 , NE1/4 NW1/4 1/4

County: BEAVERHEAD Mining District: WISDOM

Latitude: N 45° 33' 32" Longitude: W 113° 15' 23"

Primary Drainage Basin and Code: Warm Spring Creek/10020004

Secondary Drainage Basin: East Fork Warm Spring Creek

USGS Quadrangle map name(s): Stewart Mountain

Mine Type/Commodities: Hardrock/Copper, Lead, Silver, Gold

Activity Status: Active      , Inactive/Exploration      , Abandoned X .

Ownership status: Known YX N ; private/public? Public

Owner, Agent, or Contact (Include address and phone when available): BLM

Relationship to other mines/sites in the area/district: 1/4 mile from Bear Mine.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 8160' , Slope 4° ,  
Aspect Southwest

Land use: Mining      , Recreational X , Residential      , Urban      ,  
Agricultural      , Other (Specify)      Designated snowmobile, ATV,  
horseback riding trail is located near the site.

Area of disturbed/unvegetated lands? Approx. 0.5 acres.  
Dimensions:     

Predominant vegetation types: White bark and Lodgepole pines,  
grouse whortleberry, pine grass

Access: roads - good      , poor      , 4wd X , trail      .  
Other logistical considerations (proximity to other sites).       
Beaverhead Forest has closed road into mine; must walk or fly in.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Site lies at the headwaters of perennial East Fork Warm Spring Creek. The site itself is on an intermittent unnamed tributary. East Fork flows south to junction with Warm Spring Creek, approx. 3 miles from mine. The deposit is in a fissure vein cutting quartz monzonite.

Mining/milling history, ore type/tenor, host rock, gangue: Deposit was first discovered in 1869, but little development occurred. The only recorded production up until 1965 was in 1904; 70 tons of ore yielded 17 oz. of Au, 26,036 oz. of Ag, and 3101 lbs. of Pb.

Mine Operation?

Shafts - Yes X, No     , # 1, Comment Collapsed

Adits - Yes X, No     , # 2, Comment Collapsed

Pits - Yes     , No X, #     , Comment     

Placers - Yes     , No X, #     , Comment     

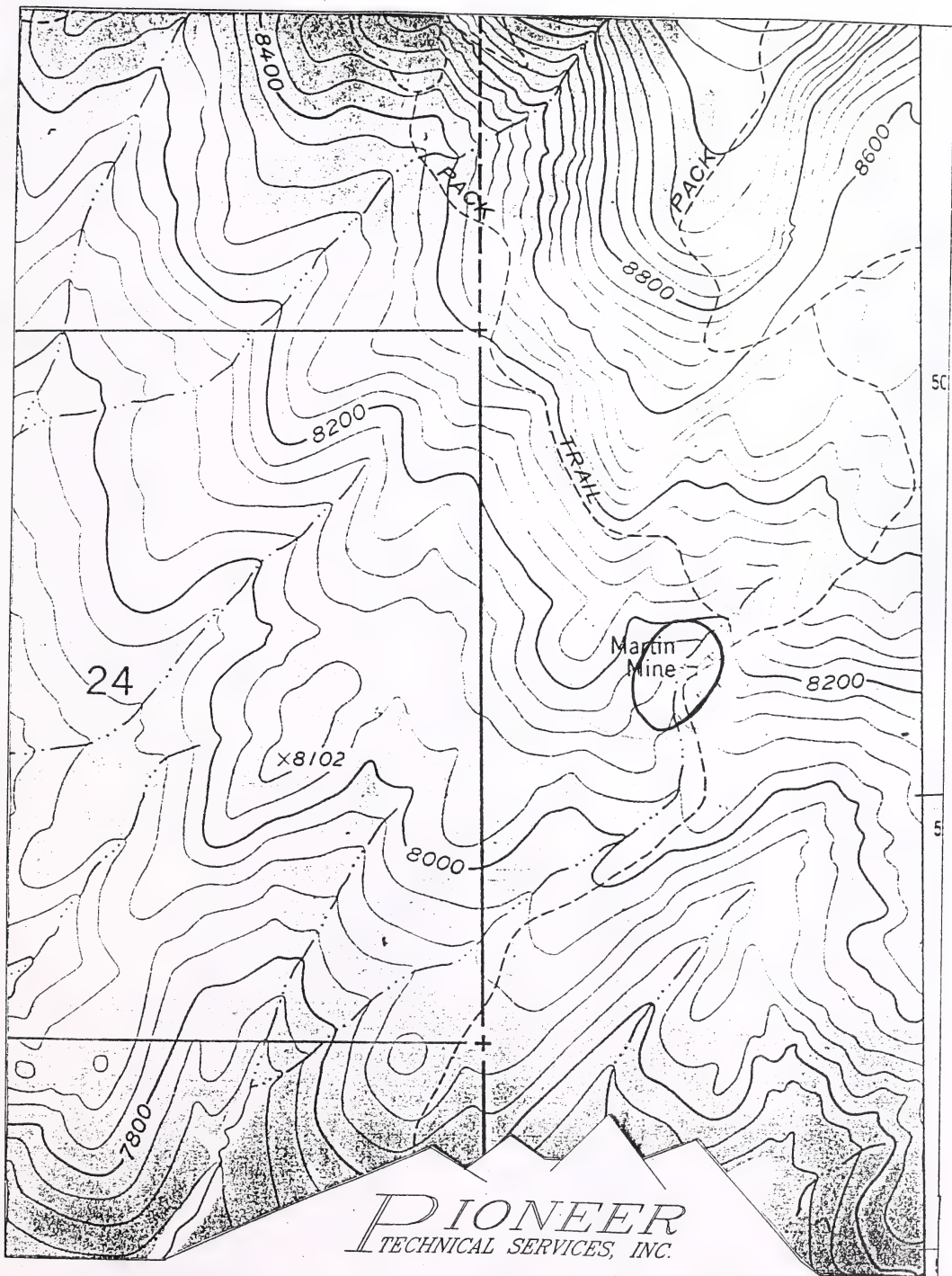
Other - Yes     , No X, #     , Comment     

Mill Operation? Yes     , No X. If yes answer the next three questions:

Period(s) of Operation: N/A

Origin of Ore Milled - Custom Mill      Dedicated Mill     ; Number and names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
N/A



*PIONEER*  
TECHNICAL SERVICES, INC.

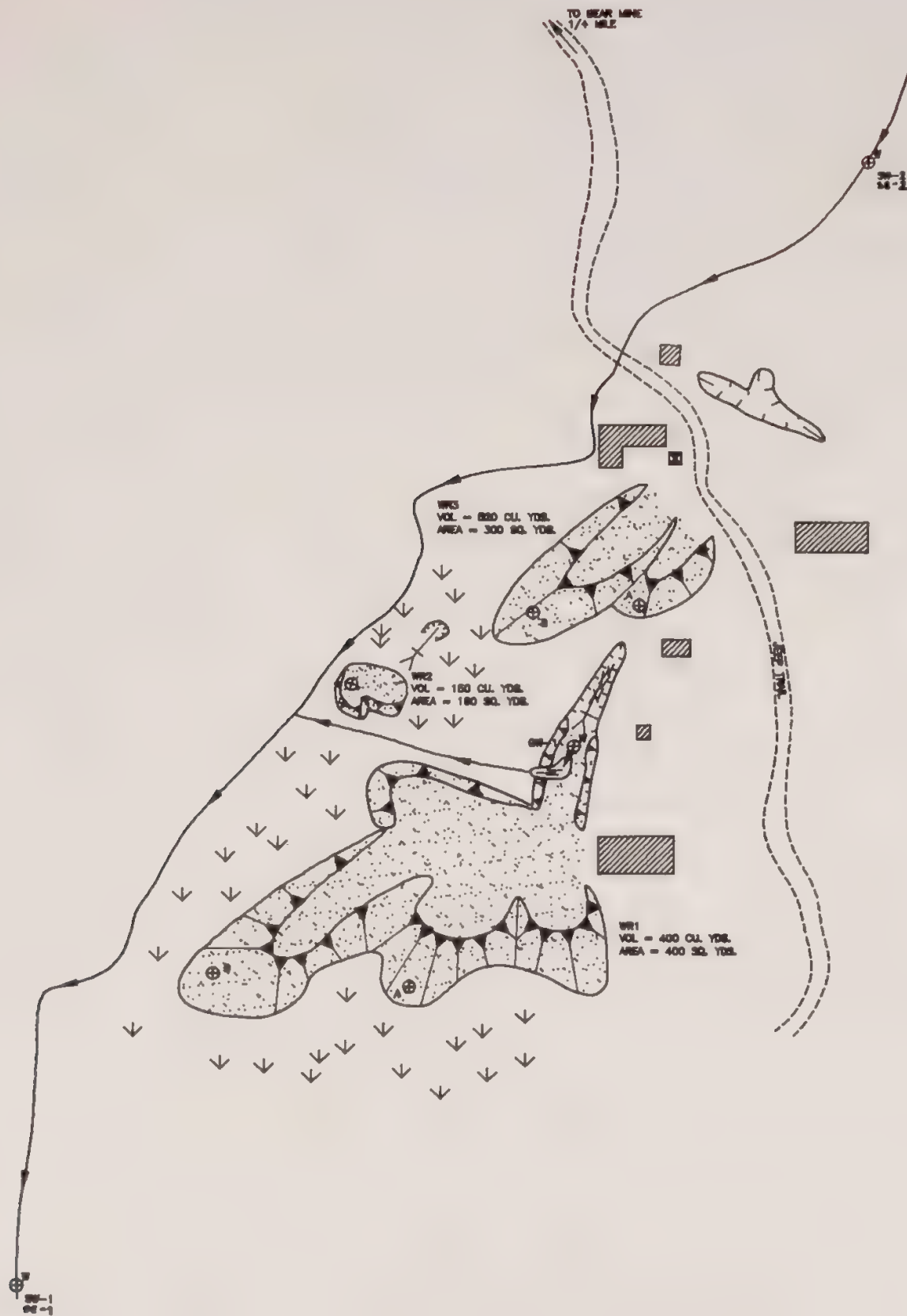
MARTIN, P.A. NO. 01-270

T03S, R13W, SECTION 19

SCALE: 1" = 1000'







SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
—	CULVERT	—	OPEN ADIT
*	LIGHT (LIGHT POLE)	—	COLLAPSED ADIT
⊙	UTILITY POLE	⊙	OPEN SHAFT
●	DECIDUOUS TREE	⊙	COLLAPSED SHAFT
⊙	CONIFEROUS TREE	⊙	EXCAVATION
—	WOOD FENCE	⊙	WHITE ROCK CLUMP
—	WIRE FENCE	⊙	COLLAPSED TIMBERS
▨	BUILDING	—	RAILS
•	BANNER POST	⊙	SOIL SAMPLE
∧	GATE	⊙	10" SAMPLE
---	EDGE OF ASPHALT	⊙	WATER SAMPLE
---	EDGE OF GRAVEL	⊙	GROUND AND SURFACE
▲	SLOPE DIRECTION	⊙	DRAINAGE
⊙	TAILINGS POND	⊙	WATER WELL
		—	PONDED WATER
		—	VEGETATED WET LANDS

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

MARTIN MINE PA# 01-270  
WISDOM DISTRICT BEAVERHEAD COUNTY

PIONEER  
ENGINEERING CONSULTANTS

TDSH

DRAWN: CAN DATE: 12/2/83  
DESIGNED: ITR JOB NO.: 83-17  
APPROVED: WJR F.B. NO.:

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON

SHEET NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A



**SAMPLERS:** Bullock, Tuesday

[illegible]

D-Direct reading (Kulwy Meter); S-Saturated Paste (Orion Meter)

Comments or deviations from SOPs: 01-270-WR-1 is composite of WR-1A and -1B, WR-2, and WR-3A and -3B.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes X, No   , Number: 1 Identification: Adit #1

Filled shafts: Yes   , No X, Number:    Identification:   

Seeps/Springs: Yes   , No X, Number:    Identification:   

Groundwater wells within 4 miles?: Yes X, No   ;  
Number of well logs: 1

Distance to nearest well used for drinking? Appears to be approx. 7  
miles to the nearest residence.

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite   , Probable X, Possible   , Unlikely   .

Adit discharge contains slightly elevated lead levels.

Other observations/notes: N/A



**SAMPLERS:** Bullock

[illegible]

FLOW: RatiOnated (R) or Measured (M) from edit, sheet, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): NM = Not measured due to meter malfunction.

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No   , Name(s): East Fork Warm Springs Creek

Dry streambeds: Yes   , No X, Name(s):   

Other surface water: Yes   , No X, Name(s)/Description:   

Waste materials within any floodplain: Yes X, No    Source ID(s): WR-1 and WR-2

Approximate Flood frequency? X 1 yr,    10 yr,    100 yr

Estimated seasonal flow of stream(s) (cfs)?     
High Flow: 2 cfs, Average Flow: 0.2 cfs

Distance between waste source(s) and nearest surface water body (ft)? 10 feet

Surface water draining onto or through waste sources: Yes X, No   , Describe:   

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Fishery, wetlands, stock watering, irrigation

Observed erosional/sedimentation/stream turbidity problems? Yes X, No   , Distance downstream (ft)? 100 Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):     
Noticeable sediment in stream downgradient of WR-1 and WR-2.

SAMPLERS: Bullock

FLOW: Estimated (E) or Measured (M)?

MDSL AMRB/PIONEER 4/9/93

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? 1 acre of gently sloping (5°) meadow below the mine.

Wetlands present: Yes X, No   , Describe: 10 acres of wetlands 1 mile below the mine.

Carbonate rocks/soils: Yes X, No   , Describe: Limestone indicated by high pH of water.

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10   ; 10-30   ; 30-100   ; 100-300   ; 300-1,000   ; 1,000-3,000   ; 3,000-10,000   ; 10,000 or greater   ; Comments None

Nearest residence(ft or miles)? Approx. 7 miles

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



## ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

**SAMPLERS:** Bullock, Tuesday

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe: \_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments None

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: Hikers  
camp near mine and use cabin for shelter.

Accessibility - Fences, warning signs, closed roads? No signs; 4 mile  
hike into mine from USFS road closure.

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment_____
Wilderness Area -	Yes____, No <u>X</u> , Comment_____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment_____
Bat Habitat -	Yes____, No <u>X</u> , Comment_____

Primary Drainage X; Secondary Drainage\_\_\_\_; No Information\_\_\_\_:

Riparian Habitat Quality -	High <u>X</u> , Medium____, Low____
Wetlands Frontage -	High____, Medium <u>X</u> , Low____
Fisheries Habitat and Species Classification -	<u>3</u>
Sport Fishery Classification -	<u>3</u>

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_  
Openings are caved.

Hazardous structures: Yes X, No\_\_\_\_, Number 6, types and locations:\_\_\_\_  
Standing and partially collapsed cabins.

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_,  
types and locations:\_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes\_\_\_\_, No X,  
Number\_\_\_\_, types and locations:\_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain:\_\_\_\_\_



## **Bibliography**

MBMG, Mines and Mineral Deposits, Pioneer Mountain Region, Montana, Beaverhead County, Wisdom District, Bulletin No. 85, Author Unknown, 1972, pp. 143-144.

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for the Martin mine, Prepared by Chen-Northern, August 25, 1989.

USGS, Topographic Map, Stewart Mountain, Montana, 7 1/2 minute Quadrangle, 1962.



LABORATORY ANALYTICAL DATA

MARTIN  
PA NO. 01-270



Martin PA# 01-270  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 09/09/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
01-270-SE-1	6.24 U	49.5 J	0.7 U	3.71 J	1.76	5.86 J	11800	0.104	285 J	3.35 U	27.9	8.13 UJ	52.5	NR
01-270-SE-2	4.67 U	79.1 J	0.5 U	4.97 J	2.28	3.57 J	11300	0.038 U	321 J	2.51 U	8.01 U	6.09 UJ	33.7	NR
01-270-WR-1	15.6	143 J	10.8	5.41 J	2.08	177 J	12100	9.26	398 J	1.86 U	1850	18 J	1240	NR
BACKGROUND	5.08	84.5 J	0.4 U	6.91 J	10.1	7.2 J	12500	0.030 U	403 J	3.54	6.85 U	5.21 UJ	37.8	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	ACID BASE %	NEUTRAL %	POTENT. %	SULFUR %	ACID BASE %	POTENT. %	ORGANIC %	PYRITIC %	ACID BASE %	POTENT. %
01-270-WR-1	0.01	0.31	9.45	9.14	<0.01	<0.01	0.01	0	0	0	9.45

WATER MATRIX ANALYSES

Metals in Water  
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
01-270-GW-1	3.72 JX	20.2	2.7	9.7 U	6.83 U	23.3	767	0.28	59.2	12.7 U	53	30.7 UJX	162	17.8
01-270-SW-1	3.18 JX	8.4	2.57 U	9.7 U	6.83 U	2.13	633	0.15	24.5	12.7 U	1.78	30.7 UJX	26.4	10.3
01-270-SW-2	1.34 JX	4.7	2.57 U	9.7 U	6.87	1.55 U	24.8	0.17	4.08 UJ	12.7 U	2.9	30.7 UJX	7.57 U	8.4

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry  
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
01-270-GW-1	81	< 5.0	< 5.0	0.12	NR
01-270-SW-1	55	< 5.0	< 5.0	0.05	NR
01-270-SW-2	47	< 5.0	< 5.0	0.05	NR

LEGEND

SE1 - Downstream of waste rock dump 3 on East Fork Warm Spring Creek.  
SE2 - Upstream of site on East Fork Warm Spring Creek.  
WR1 - Composite of subsamples WR1A, 1B, 2, 3A, and 3B.  
BACKGROUND - From the Martin Mine (01-270-SS-1).

GW1 - Large collapsed adit in drainage.

SW1 - Same as sample SE1.

SW2 - Same as sample SE2.





XRF ANALYSIS RESULTS

MARTIN  
PA NO. 01-270



Mine Name: Martin PA# 01-270  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
01-270-WR1-A		20555.7	8132.45	827.433		679.124 *	19130.6		324.637	5890.56		119.282
01-270-WR1-B		31261.3	5121.89	1263.53		978.868	24403.4		142.457 *	831.195		96.7496
01-270-WR3-A		33545.8	3672.62	1405.74		593.129 *	19831.1	226.563 *	262.614	336.223		80.5065
01-270-WR3-B		20809.2	9211.72	1056.24		1056.62	22579.2			112.358 *		124.728
01-270-WR-1-COMP		27031.9	5895.22	1012.25		742.819 *	19963		135.358 *	1418.64		98.0638
01-270-WR-2		32235.8	4305.05	1094.57		535.77 *	14689.8	202.213 *	129.809 *	405.737		97.8806
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
01-270-WR1-A	100.955			788.898	181.028		81.7643 *	429.491		12.8281 *		
01-270-WR1-B	103.397		12.1466 *	1344.59	245.274		101.082 *	464.969	83.5476 *	12.4823 *		
01-270-WR3-A	109.918		16.5792	564.915	271.331		84.4548 *	393.484			11.5787 *	
01-270-WR3-B	109.127				208.061			402.502			14.3935 *	
01-270-WR-1-COMP	106.85			515.944	220.753		53.1943 *	433.022	91.2258 *		14.7624 *	
01-270-WR-2	119.914				272.79		58.7028 *	236.23			14.6537 *	

\* - Estimated Quantity  
\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

MARTIN  
PA NO. 01-270





# AIMSS SCORESHEET

SITE NAME:

MARTIN

PA NUMBER:

01-270

LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.987
6		WELLS - 1 MI. x 2.5		0.0
7	GW - TARGETS	WELLS - 1 TO 4 MI		1
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	1.0
10		<b>GROUNDWATER SCORE</b>	<b>LINES 4 x 5 x 9</b>	<b>795</b>
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		50
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	750
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	2.185
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		10
19	SW - TARGETS	FISHERY		5
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	22
24		<b>SURFACE WATER SCORE</b>	<b>LINES 14 x 15 x 23</b>	<b>36053</b>
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.021
29		POPULATION - 4 MILES		0
30		NEAREST RESIDENCE		0
31	AIR - TARGETS	WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	10
35		<b>AIR PATHWAY SCORE</b>	<b>LINES 27 x 28 x 34</b>	<b>11</b>
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.019
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		0
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		10
43		TARGETS SCORE	SUM LINES 40 - 42	10
44		<b>DIRECT CONTACT SCORE</b>	<b>LINES 38 x 39 x 43</b>	<b>19</b>
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			<b>0.37</b>
	(LINES 10 + 24 + 35 + 44) / 100,000			

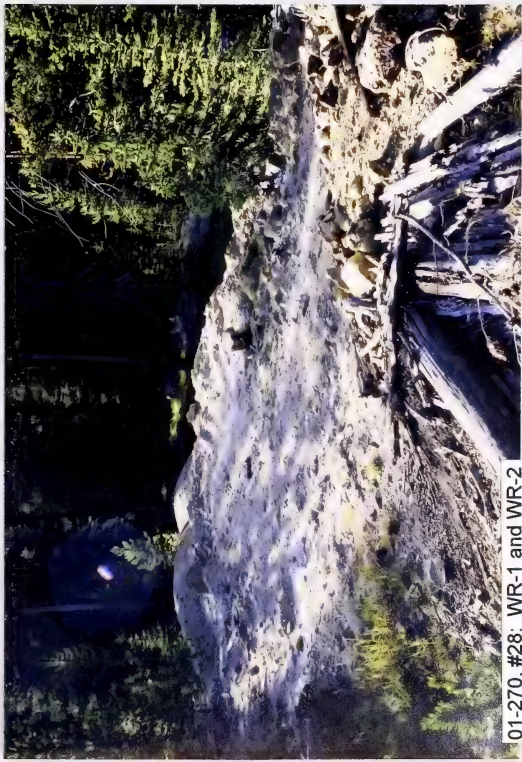
LINE  
NO.

SITE NAME:  
PA NUMBER:

MARTIN  
01-270

**SITE SAFETY**

1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	240
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	240
9		POPULATION - 1 MILE		0
10	TARGETS	NEAREST RESIDENCE		0
11		RECREATIONAL USE		10
12		TARGETS SCORE	SUM LINES 9 - 11	10
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>24.00</b>















MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: MILLER PA#: 04-138

Date: July 26, 1993 Time: 1410

Field Team Leader: Babits, Pioneer

Sampling Personnel: Flammang, Pioneer  
Lasher, Pioneer

Visitors: None

Weather/Seasonality Observations: Constant rain; fog; cool (55°F);  
cool, rainy spring and summer; runoff occurring from site, 0.78"  
during site visit.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #16: WR-2, facing  
west; #17: Adit at WR-1. Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms):  
Recent trenching and drill holes, sample bags on site from drill-  
ing. Site accessed by truck.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Adit  
discharge is acid pH with Ni above Maximum Contaminant Levels and  
should be abated. Waste rock is not large, but steep; revegetation  
will be difficult.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): MILLER PA#: 04-138

Legal Description: T 10N ; R 2E ; Sec. 13 , SW 1/4 SE 1/4 1/4

County: BROADWATER Mining District: CONFEDERATE

Latitude: N 46° 37' 12" Longitude: W 111° 24' 58"

Primary Drainage Basin and Code: Confederate Gulch/10030101

Secondary Drainage Basin: Greenhorn Gulch

USGS Quadrangle map name(s): Diamond City

Mine Type/Commodities: Hardrock/Gold

Activity Status: Active      , Inactive/Exploration X , Abandoned      .

Ownership status: Known YX N ; private/public? Private

Owner, Agent, or Contact (Include address and phone when available): W.A. Stiles and Hugh McDaniel, Clancy, MT 59634; c/o Pegasus Gold Corporation, Butte, MT 59701.

Relationship to other mines/sites in the area/district: Mine is on same contact (Grayson shale and quartz diorite) as Hummingbird mine; same type of deposit.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 5400'-6300' , Slope Approx. 30° ,  
Aspect Southwest

Land use: Mining X , Recreational X , Residential      , Urban      ,  
Agricultural X , Other (Specify)     

Area of disturbed/unvegetated lands? 1.05 acres.  
Dimensions:     

Predominant vegetation types: Douglas fir, sage, grasses, wild roses

Access: roads - good X , poor      , 4wd      , trail      .  
Other logistical considerations (proximity to other sites).       
Approx. 1/2 mile below Hummingbird mine.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach MBMG Well Log Printout(s): There is 1 well log within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Adit #1 discharge is headwaters of intermittent Greenhorn Gulch drainage. Greenhorn flows south out of site, to confluence with perennial Confederate Gulch 1 1/2 mi. away. Well on site indicates groundwater near Adit #1 is 63' bgs. Site lies on contact between Precambrian age Grayson shales and a cretaceous quartz diorite.

Mining/milling history, ore type/tenor, host rock, gangue: Mine worked on small scale since 1901. From 1901-1948, 9,108 oz. Au, 5,329 oz. Ag, 3,297 lbs. Cu, and 1,179 lbs. Pb were produced from 1,146 tons of ore. Mine worked intermittently since; exploration in 1968-69, 1977, 1984, 1986, and 1988. Ore is found in quartz stringers and veinlets along the contact of Grayson shale with cretaceous quartz diorite. Ore is also found in the quartz gangue mainly in the bedding planes of the shales. Pyrite is most common mineral with small amounts of chalcopyrite, galena, sphalerite, chodochrosite, and free gold.

#### Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 5, Comment 2 open; 1 partially open; 2 caved  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes X, No     , # 1, Comment Trench

Mill Operation? Yes X, No     . If yes answer the next three questions:

Period(s) of Operation: 1900 to 1948; single stamp amalgamating mill

Origin of Ore Milled - Custom Mill      Dedicated Mill X; Number and names of mines that supplied mill feed: Miller mine

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting? Amalgamating



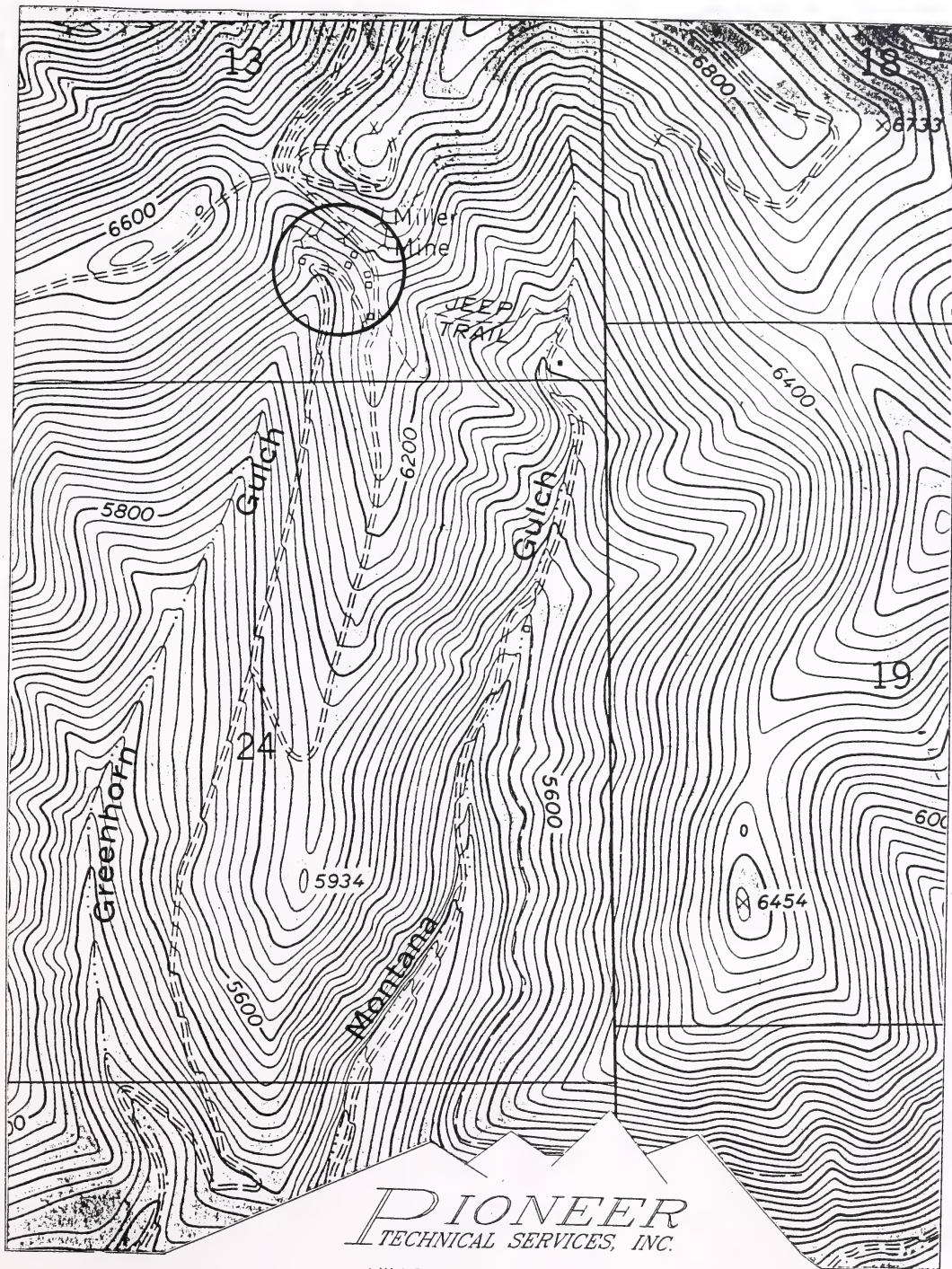
*Confidential*

Montana Bureau of Mines and Geology  
Water Well Log Data

06/10/1993

Well No.: M:23111  
Location: 10N 02E 12 BB  
Site Name: TROTCHIE RAY  
County: Lewis & Clark  
Depth: 147.0  
Yield: 30.0  
Static Water Level: 67.00  
Pumping Water Level: 0.0  
Year drilled: 1988  
Driller:  
Driller's License: 007  
DNRC Well No.:





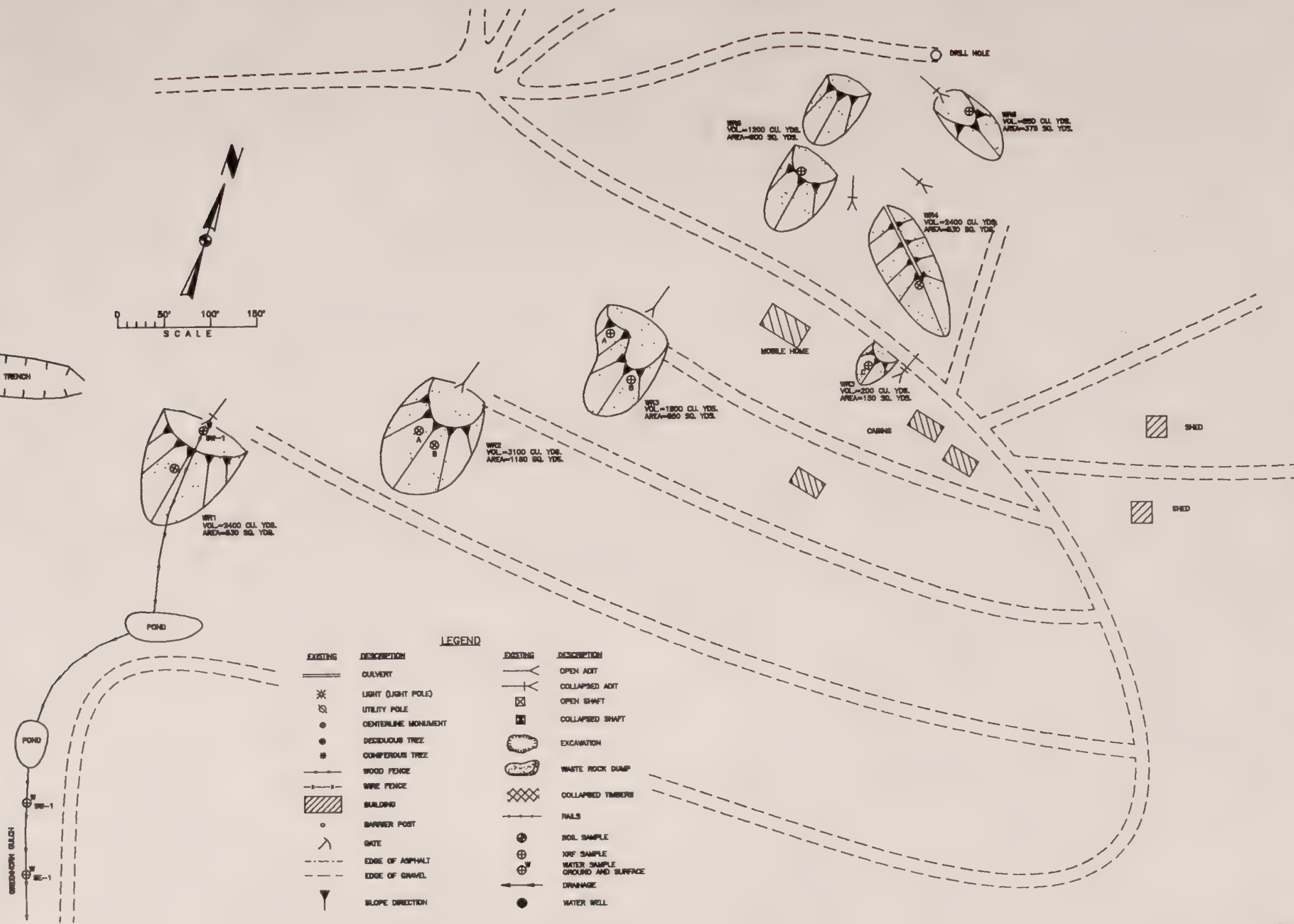
**PIONEER**  
TECHNICAL SERVICES, INC.

MILLER, P.A. NO. 04-138

TION, R02E, SECTION 13

SCALE: 1" = 1000'





**PIONEER**  
ENGINEERING & CONSULTANTS

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS—BOZEMAN—KALISPELL  
SPOKANE

DATE: 28 SEPT. 83  
JOB NO.: 83-17  
F.B. NO.:  
DRAWN: JTP  
DESIGNED: TPR  
APPROVED: MUR

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

MILLER MOUNTAIN PA# 04-138  
CONFEDERATE DISTRICT BROADWATER COUNTY

SHEET NO. 04-138.DWG SHEETS





## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A



SOURCE INVENTORY FORM

SAMPLERS: Flammang, Lasher

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
WR-1	WR	2,400	Southeast of Adit #1 near drainage on south near top	None	< 3.5 (D)	0.06	04-138-WR-1	07/26/93 0700	T-Metals, ABA
WR-2A	WR	3,100	WR-2 east of Adit #2 southern lobe near top	None	5.2 (D)	0.05			
WR-2B	WR		Lower than WR-2A and 15' north	None	3.6 (D)	0.04			
WR-3A	WR	2,000	WR-3 east of Adit #3 on southern end of dump near top	None	5.0 (D)	0.05	04-138-WR-2	07/26/93 0710	T-Metals, ABA
WR-3B	WR		On larger lobe of WR-3 north end	None	5.0 (D)	0.05			
WR-3C	WR		Small dump north of mobile home, below top road	None	6.6 (D)	0.05			
WR-4	WR	2,400	Off north nose of WR-4 closest dump to road Junction on west side of site	None	5.2 (D)	0.05	04-138-WR-3	07/26/93 0720	T-Metals, ABA
WR-5	WR	1,200	Upper southwest dump and on south facing slope near top of lower dump	None	6.6 (D)	0.04			
WR-6	WR	850	WR-6 north of WR-4 on north facing slope near top	None	6.7 (D)	0.06			

\*Direct reading(Radiac Meter); R-Retested Beta(Radiac Meter)

Comments or deviations from SOPs: 04-138-WR-1 is composite of WR-1, and WR-2A and -2B.  
 04-138-WR-2 is composite of WR-3A through -3C. 04-138-WR-3 is composite of WR-4, -5, and -6.  
 Background soil collected at Hummingbird (04-144).

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes X, No     , Number: 1 Identification: Adit #1

Filled shafts: Yes     , No X, Number:      Identification:     

Seeps/Springs: Yes X, No     , Number: 1 Identification: Possible expression of adit discharge

Groundwater wells within 4 miles?: Yes X, No     ;  
Number of well logs: 11

Distance to nearest well used for drinking? 1 mile

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite     , Probable     , Possible X, Unlikely     .

Uncontained source; but, deep aquifer.

Other observations/notes: N/A

## SAMPLERS: Babits

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):



### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): Greenhorn Gulch

Dry streambeds: Yes     , No X, Name(s):     

Other surface water: Yes X, No     , Name(s)/Description: Flowing adit (Adit #1)

Waste materials within any floodplain: Yes X, No      Source ID(s):       
Waste rock is in Greenhorn Gulch headwaters.

Approximate Flood frequency? X 1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)? 10 gpm  
High Flow: 25 gpm, Average Flow: 5 gpm

Distance between waste source(s) and nearest surface water body (ft)? 0 feet; Adit #1 discharge flows over WR-1. Pond below WR-1 appears to be on waste rock.

Surface water draining onto or through waste sources: Yes X, No     ,  
Describe: Adit #1 discharge flows over WR-1.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Fishery, irrigation, wetland

Observed erosional/sedimentation/stream turbidity problems? Yes X, No     , Distance downstream (ft)? 100' Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):       
Roads are source of sedimentation; adit discharge erodes WR-1.



**SAMPLERS:** Babits

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

#### D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? None

Wetlands present: Yes , No X , Describe:

Carbonate rocks/soils: Yes , No X , Describe:

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10\_\_\_; 10-30\_\_\_; 30-100\_\_\_;  
100-300\_\_\_; 300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or  
greater\_\_\_; Comments None

Nearest residence(ft or miles)? 5 miles

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?    Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none

**ACID DRAINAGE/AIR PATHWAY INVENTORY FORM**

SAMPLERS: Babits, Flammang, Lasher

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL(OBSERVED/HIGH /MODERATE/LOW/POOR)
WR-1	SO3, pH	Dry	7,470	7,096	No	Low
WR-2	SO3, pH	Dry	10,350	8,280	Yes	Low
WR-3A, -3B	SO3	Dry	7,650	1,913	Yes	None
WR-3C	SO3	Dry	1,350	270	Yes	None
WR-4	SO3	Dry	7,470	6,723	No	Low
WR-5	SO3	Dry	8,100	3,240	No	Low
WR-6	None	Dry	3,375	2,193	No	None
Adit 1	Low pH	N/A	N/A	N/A	N/A	N/A

**Notes and Clarifications:**

#### F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe:

Population within 1 mile: 1-10\_\_\_; 10-30\_\_\_; 30-100\_\_\_; 100-300\_\_\_;  
300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or greater\_\_\_;  
Comments None

Evidence of recreational use on site: Yes X, No   , Describe: Gun shell casings on WR-5 (upper); beer cans

Accessibility - Fences, warning signs, closed roads? "No Trespassing" signs

**Sensitive environments on-site or adjacent to site:**

State or National Parks - Yes\_\_\_, No X, Comment\_\_\_\_\_

Wilderness Area - Yes\_\_\_, No X, Comment\_\_\_\_\_

T&E Species Habitat - Yes\_\_\_, No X, Comment\_\_\_\_\_

Bat Habitat - Yes X, No\_\_\_, Comment Open adits

Primary Drainage X ; Secondary Drainage ; No Information :

Riparian Habitat Quality -	High	Medium	Low	Not Rated
Wetlands Frontage -	High	Medium	Low	Not Rated
Fisheries Habitat and Species Classification -				<u>4</u>
Sport Fishery Classification -	4			

## G. SAFETY CHARACTERISTICS

## Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No   , Number 3, types and locations: Adit #2 has a 3'x3' opening near top of caved adit; Adits #1 and #3 are open.

Hazardous structures: Yes X, No   , Number 2, types and locations: Two sheds on flat area are unstable. There are several other  
structures on the site: two cabins, one old mobile home, and one locked  
shed.

Unstable highwalls, pits, trenches, slopes: Yes X, No     , Number 2,  
types and locations: Highwall above Adit #1; trench located east of  
Adit #1

Unstable waste piles, impoundments, undercut banks: Yes X, No     ,  
Number 5, types and locations: WR-2 actively sluffing onto road;  
WR-1, -3, -4, and -5 have steep, unvegetated slopes down to roads.

Fire and/or Explosion hazards: Yes X, No   , Explain: Old wooden buildings



## **Bibliography**

- Guardian Resource Corporation, Extracts from Kyle Consultants Report, November 30, 1984.
- MBMG, Mineral and Industry File 90.0, Miller Mine, Broadwater County, Montana.
- MBMG, Well Log Database, September 8, 1993.
- MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.
- MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Miller, Prepared by Northern Engineering and Testing, June 30, 1988.
- MDSL/AMRB Files, Report on the Miller Mine, Helena, Montana, Written by Fred J. Hemsworth, July 2, 1969.
- USGS, Topographic Map, Diamond City, Montana, 7 1/2 minute Quadrangle, 1966.





LABORATORY ANALYTICAL DATA

MILLER  
PA NO. 04-138



Miller PA# 04-138  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BABITS  
INVESTIGATION DATE: 07/26/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
04-138-SE-1	9	109	1.6	8.6	16.1	30.3	29100	0.221 J	365	21 J	59	7 UJ	125	NR
04-138-WR-1	10	152	1.6	5.5	7.4	91.8	27200	1.57 J	247	14 J	135	7 UJ	102	NR
04-138-WR-2	24	156	3.2	13.5	5.2	902	54600	2.46 J	452	10 J	89	6 UJ	59	NR
04-138-WR-3	27	293	4.1	13.8	8.3	2520	52600	2.39 J	1540	26 J	2960	6 UJ	250	NR
BACKGROUND	20	98.5	0.8	5.8	11.9	21.6	14100	0.042 J	419	10 J	22	6 UJ	66	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL SULFUR ACID BASE 1/1000	NEUTRAL POTENT. 1/1000	SULFUR ACID BASE POTENT. 1/1000	SULFATE %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC SULFUR ACID BASE POTENT. 1/1000	SULFUR ACID BASE POTENT. 1/1000
04-138-WR-1	1.38	43.1	48.6	5.45	0.46	0.59	0.33	18.4	30.1
04-138-WR-2	0.57	17.8	32.1	14.3	0.14	0.16	0.27	5.00	27.1
04-138-WR-3	0.24	7.50	21.4	13.9	0.12	0.06	0.06	1.87	19.5

WATER MATRIX ANALYSES

Metals in Water  
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO3/L)	HARDNESS CALC. Zn (mg CaCO3/L)
04-138-SW-1	1	2.01 U	2.57 U	78.8	6.83 U	189	83300	0.13	7000 J	145	7.03	30.7 U	1920	1090

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry  
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
04-138-SW-1	1810	< 5.0	1160	< 0.05	NR

LEGEND

SE1 - 300 feet from waste rock dump 1 in Greenhorn Gulch  
WR1 - Composite of subsamples WR1, 2A, and 2B.  
WR2 - Composite of subsamples WR3A, 3B, and 3C.  
WR3 - Composite of subsamples WR4, 5, and 6.  
BACKGROUND - From the Hummingbird Mine (04-144-SS-1).  
SW1 - Discharge from adit #1.



XRF ANALYSIS RESULTS

MILLER  
PA NO. 04-138





Mine Name: Miller PA# 04-138  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHI	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
04-138-WR2-A		10113.7	36381.1	1584.48		394.469 *	51088.8		79.1734 *	115.176 *		107.111
04-138-WR2-B		14571.4	20144	1368.22			29761.2		161.518 *			59.0245
04-138-WR3-A		12875.9	2269.19	987.077			92150.2		228.974 *		73.2783 *	42.2967
04-138-WR3-B		10656.9	5063.81	578.931			46656.5		907.2			36.739
04-138-WR3-C		19431.3	20136.7	1275.95			58204.3		131.468 *	163.952 *	49.5565 *	249.972
04-138-WR-1	292.802 *	14420.5	23573.1	1559.31			43070.3		73.3274 *	213.92		116.148
04-138-WR-1-COMP		15383.3	24424.7	1573.15			38645.5			178.863		88.9351
04-138-WR-2-COMP		17558	7017.12	1047.36			64894.1		438.652	107.311 *		55.5849
04-138-WR-3-COMP		18030.7	6176.98	778.928			65036.5		3042.66	236.347		53.6288
04-138-WR-4		18618.5	8076.31	998.909			77614.3		239.93	273.474	22.2922	408.926
04-138-WR-5		15240.6	10106.6	1128.89			52551.7		396.549	254.081		52.7004
04-138-WR-6		16927.4	1600.87	656.734			73503.2		1950.78			33.3313
Zr												
	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th		
04-138-FE					2163.35 *							
04-138-WR2-A	83.3733			100.639			314.89				7.98659 *	
04-138-WR2-B	116.12	26.9649	29.7466 *	51.9808			310.18	122.589 *			6.71429 *	
04-138-WR3-A	86.2396	23.2761	134.716	80.9598			442.758	146.096 *				
04-138-WR3-B	77.5433	8.6385 *	32.5744 *	68.0033			355.67	117.07 *		11.8391 *	7.60607 *	
04-138-WR3-C	114.108			96.9593			289.623				11.4813 *	
04-138-WR-1	94.5652	6.4404 *	83.1649	83.5956			306.51			11.7184 *	9.55165 *	
04-138-WR-1-COMP	117.731	9.00937 *	112.266	80.6457			356.266			13.1634 *		
04-138-WR-2-COMP	96.4925	12.555 *	187.997	102.494			805.647			10.3114 *		
04-138-WR-3-COMP	82.1263	40.5526	1588.39	94.0819			745.955					
04-138-WR-3-COMP	100.032	24.6891	163.421	119.102			555.233		119.919 *		6.85153 *	
04-138-WR-4	93.1569	68.4412	3178.85	84.888			294.552		91.7881 *			
04-138-WR-5	58.1142	21.3616	123.801	61.2551			1183.55		142.957 *			
04-138-WR-6									131.271 *			

\* - Estimated Quantity  
\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

MILLER  
PA NO. 04-138



# **AIMSS SCORESHEET**

SITE NAME:

MILLER

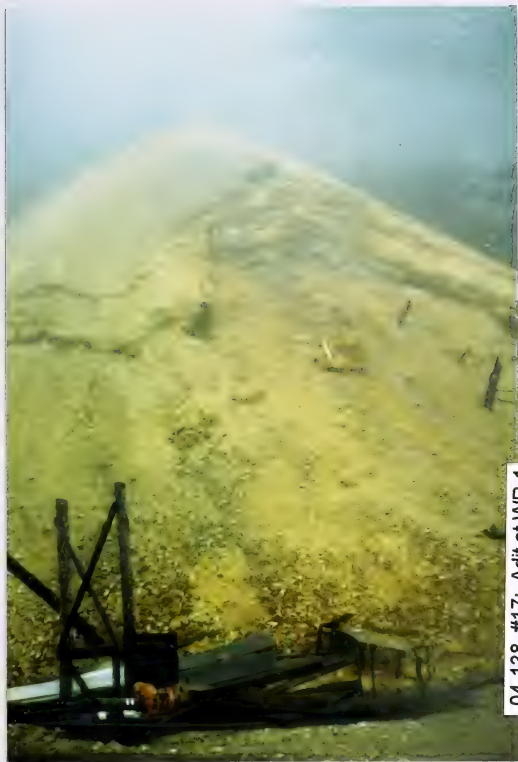
PA NUMBER:

04-138

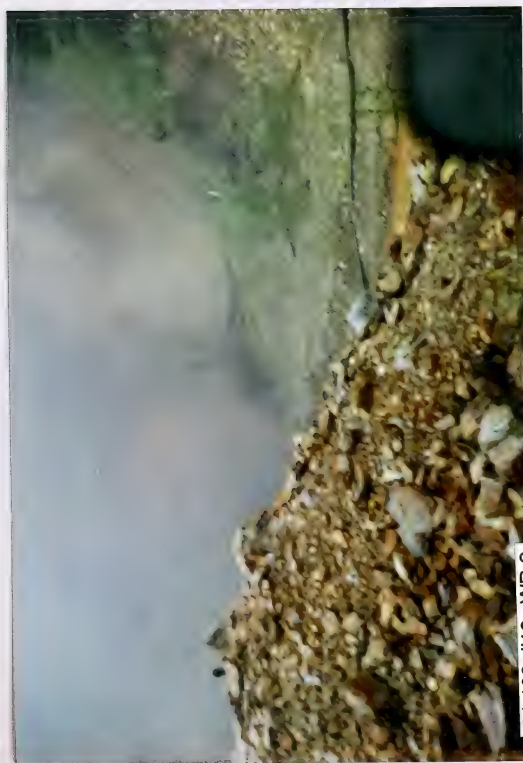
LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	11.338
6		WELLS - 1 MI. x 2.5		2.5
7	GW - TARGETS	WELLS - 1 TO 4 MI		10
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	12.5
10		GROUNDWATER SCORE	LINES 4 x 5 x 9	28345
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		0
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		10
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	200
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	200
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	13.364
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		10
19	SW - TARGETS	FISHERY		1
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	18
24		SURFACE WATER SCORE	LINES 14 x 15 x 23	48110
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.349
29		POPULATION - 4 MILES		0
30		NEAREST RESIDENCE		0
31	AIR - TARGETS	WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	0
35		AIR PATHWAY SCORE	LINES 27 x 28 x 34	0
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.310
40	DIRECT CONTACT	POPULATION - 1 MILE		0
41	TARGETS	NEAREST RESIDENCE		0
42		RECREATIONAL USE		5
43		TARGETS SCORE	SUM LINES 40 - 42	5
44		DIRECT CONTACT SCORE	LINES 38 x 39 x 43	155
45	TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE			0.77
	(LINES 10 + 24 + 35 + 44) / 100,000			

		SITE NAME:		MILLER
		PA NUMBER:		04-138
LINE NO.	SITE SAFETY			
1	THREAT	ACCESSIBILITY		10
2	HAZARDS	OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	150
4		UNSTAB. HIWALLS / PITS	75 EA.	150
5		HAZ. STRUCTURES	40 EA.	80
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	380
9	TARGETS	POPULATION - 1 MILE		0
10		NEAREST RESIDENCE		0
11		RECREATIONAL USE		5
12		TARGETS SCORE	SUM LINES 9 - 11	5
13	SITE SAFETY SCORE		(LINES 1 x 8 x 12) / 1,000	19.00

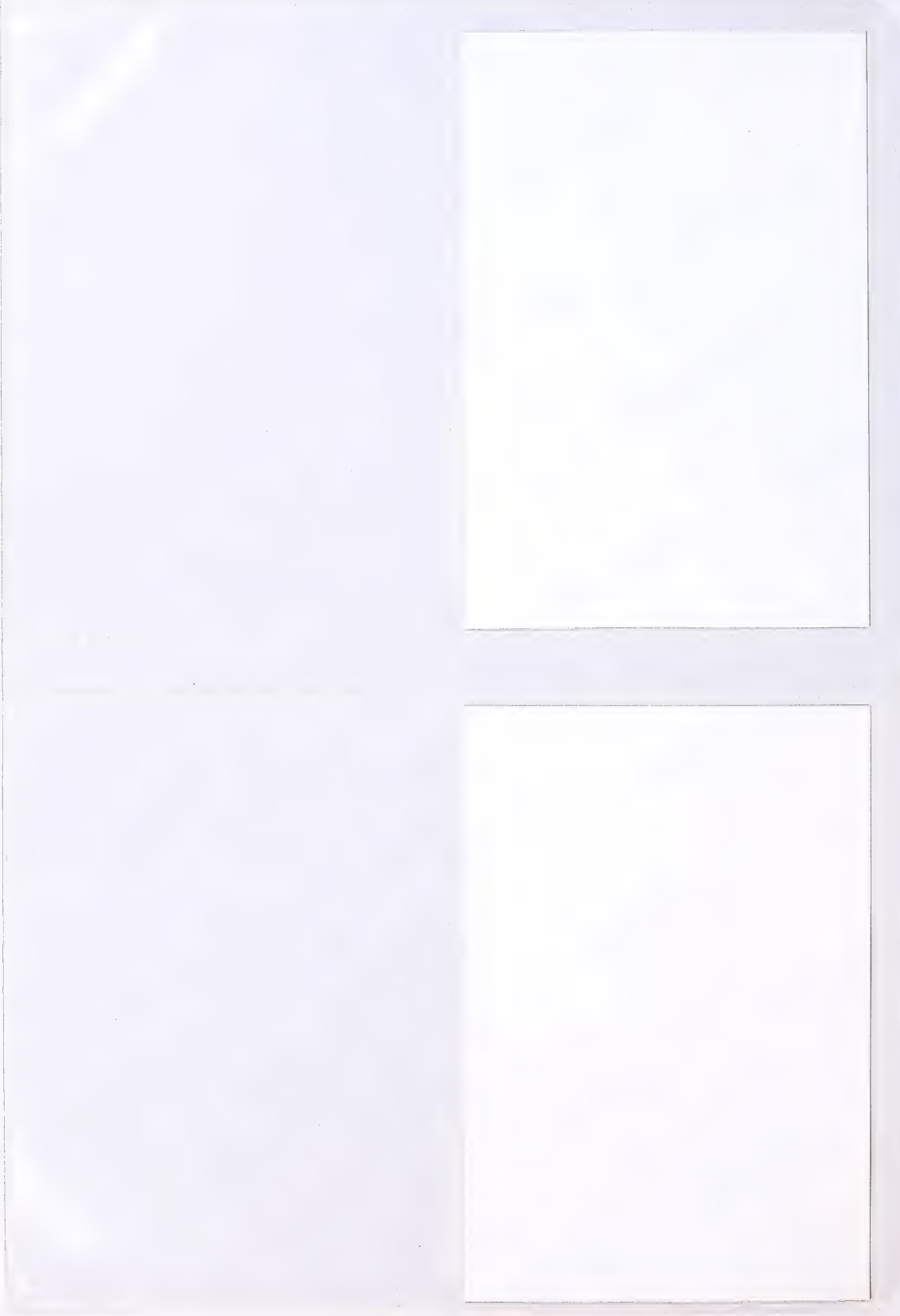




04-138, #17: Adit at WR-1



04-138, #16: WR-2



MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: HUMMINGBIRD PA#: 04-144

Date: July 26, 1993 Time: 1200

Field Team Leader: Babits, Pioneer

Sampling Personnel: Flammang, Pioneer  
Lasher, Pioneer

Visitors: Unidentified surveyor

Weather/Seasonality Observations: Rain; cool (50°F); slight breeze (< 5 mph); wet, cool spring and summer; runoff occurring from site, 0.78" of rain during site visit.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): No photos or video were taken.

General Comments/Observations (not covered specifically in attached Inventory Forms): Recent drillholes present at site. Surveyor may have been performing magnetometer survey for exploration.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Dumps are beginning to revegetate on their own; however, they may do better if slopes were flattened and topsoil added.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): HUMMINGBIRD PA#: 04-144

Legal Description: T 10N ; R 2E ; Sec. 13 , SE 1/4 NE 1/4 1/4

County: BROADWATER Mining District: CONFEDERATE

Latitude: N 46° 37' 40" Longitude: W 111° 24' 45"

Primary Drainage Basin and Code: White Creek/10030101

Secondary Drainage Basin: Johnnys Gulch

USGS Quadrangle map name(s): Whites City

Mine Type/Commodities: Hardrock/Gold, Silver

Activity Status: Active     , Inactive/Exploration X , Abandoned     .

Ownership status: Known YX N ; private/public? Private/Public  
Owner, Agent, or Contact (Include address and phone when available): Virginia  
McMurty, 2890 South Clarkson Street, Englewood, CO 80110. (303)  
781-5859; c/o Pegasus Gold Corporation, Butte, MT 59701; Helena  
National Forest.

Relationship to other mines/sites in the area/district: On same  
contact of Grayson shale and quartz diorite as Miller mine.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 6500' , Slope 24° ,  
Aspect West

Land use: Mining X , Recreational     , Residential     , Urban     ,  
Agricultural     , Other (Specify)    

Area of disturbed/unvegetated lands? 0.4 acres.  
Dimensions:    

Predominant vegetation types: Ponderosa and Lodgepole pines,  
Douglas fir, shrubs

Access: roads - good     , poor     , 4wd X , trail     .  
Other logistical considerations (proximity to other sites).      
1/2 mile above Miller mine on same road.



Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There is 1 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Site lies above headwaters of Johnny's  
Gulch. Water from site flows west approx. 1/4 mile to confluence  
with intermittent Johnny's Gulch drainage. Johnny's Gulch flows  
south then west to the confluence with perennial Whites Gulch.  
Site lies on or near the contact of Precambrian Grayson shale with  
cretaceous age quartz diorite stock.

Mining/milling history, ore type/tenor, host rock, gangue:  
Operated from 1917 to 1949. Vein minerals are pyrite, limonite,  
and sparse chalcopyrite; veins are stringers of quartz along  
bedding planes of Grayson shale next to contact with cretaceous  
quartz diorite. Quartz gangue; 1.25 oz. Au/ton and 1.7 oz. Ag/ton.

Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 5, Comment All caved  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

Mill Operation? Yes     , No X. If yes answer the next three  
questions:

Period(s) of Operation: N/A; ore shipped to stamp mill in Hour  
Gulch

Origin of Ore Milled - Custom Mill      Dedicated Mill     ; Number and  
names of mines that supplied mill feed: N/A

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
N/A



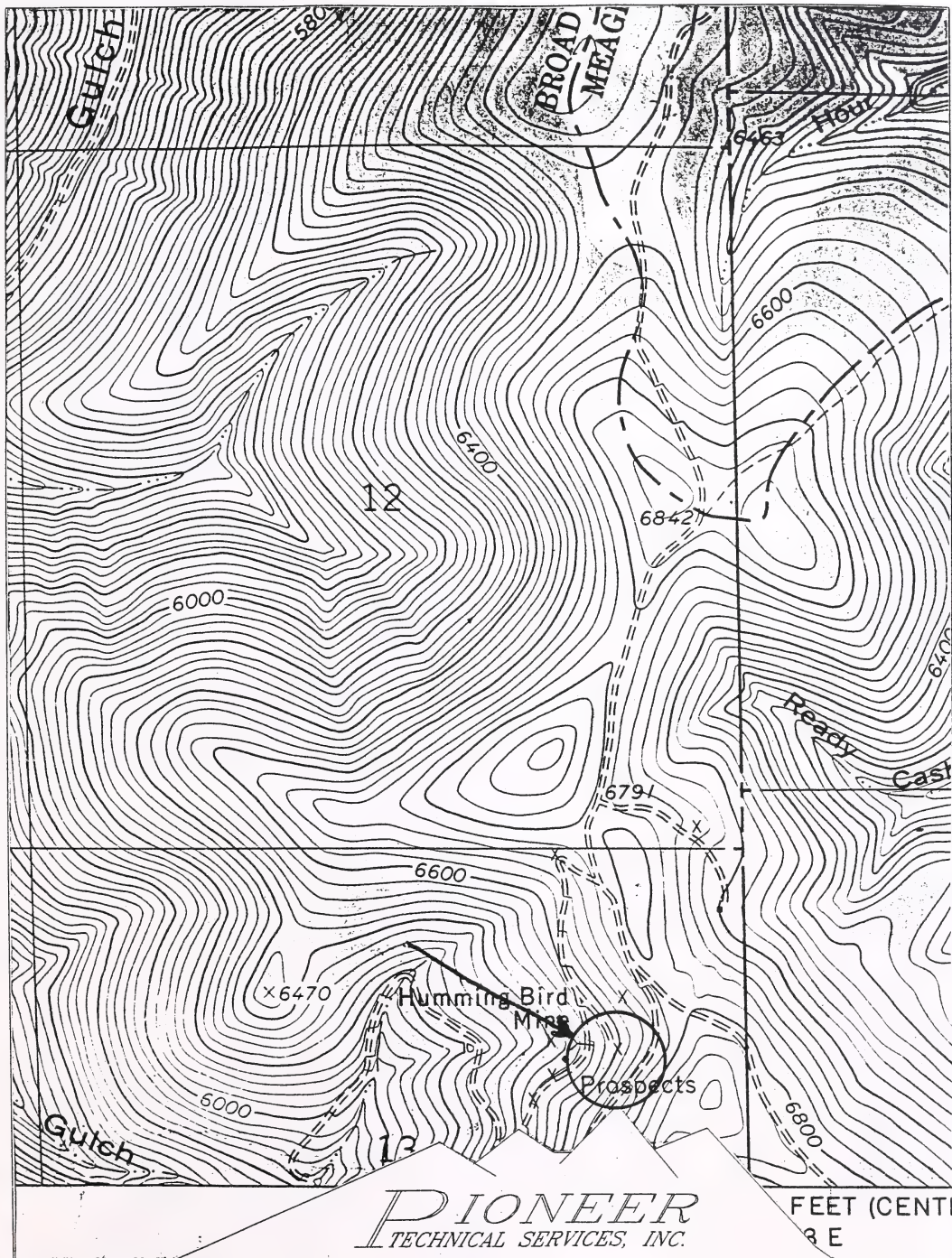
Confederate

Montana Bureau of Mines and Geology  
Water Well Log Data

06/10/1993

Well No.: M:23111  
Location: 10N 02E 12 BB  
Site Name: TROTCHIE RAY  
County: Lewis & Clark  
Depth: 147.0  
Yield: 30.0  
Static Water Level: 67.00  
Pumping Water Level: 0.0  
Year drilled: 1988  
Driller:  
Driller's License: 007  
DNRC Well No.:





**PIONEER**  
TECHNICAL SERVICES, INC.

FEET (CENT)  
8 E

HUMMINGBIRD, P.A. NO. 04-144

T10N, R02E, SECTION 13

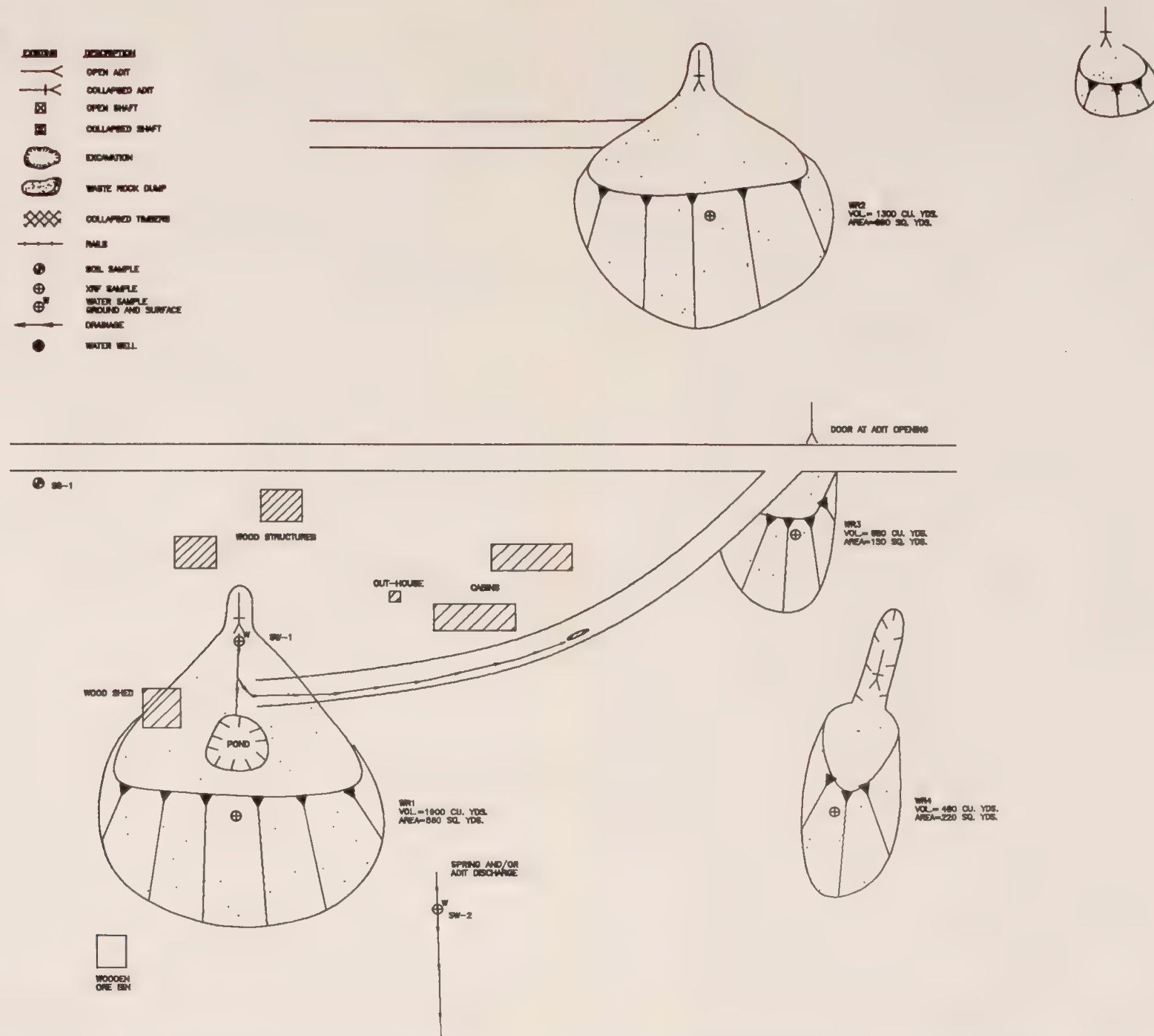
SCALE: 1" = 1000'



SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CULVERT		OPEN ADIT
	LIGHT (LIGHT POLE)		COLLAPSED ADIT
	UTILITY POLE		OPEN SHAFT
	CENTERLINE MONUMENT		COLLAPSED SHAFT
	DECIDUOUS TREE		EXCAVATION
	CONIFEROUS TREE		WASTE ROCK DUMP
	WOOD FENCE		COLLAPSED TIMBERS
	WIRE FENCE		RAILS
	BUILDING		SOIL SAMPLE
	BARBER POST		10' SAMPLE
	GATE		WATER SAMPLE
	EDGE OF ASPHALT		GROUND AND SURFACE
	EDGE OF GRAVEL		DRAINAGE
	SLOPE DIRECTION		WATER WELL



NOT TO SCALE



DRAWN JTP DATE 24 SEPT 93  
DESIGNED JTR JOB NO. 03-17  
APPROVED MUB F.B. NO.

**PIONEER**  
ENGINEERING & CONSULTANTS

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON

**TDSH**

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

HUMMINGBIRD PA# 04-144  
CONFEDERATE DISTRICT BROADWATER COUNTY

SHEET NO.





## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): N/A

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): N/A

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): N/A

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): N/A

Comments on potential for mitigation: N/A



**SAMPLERS:** Babits, Flammang, Lasher

[illegible]

D-Direct reading (Kelvey Meter); B-Saturated Paste (Orion Meter)

**Comments or deviations from SOPs:** 04-144-WR-1 is composite of WR-1, -2, -3, and -4.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes X, No   , Number: 1 Identification: North of log cabins

Filled shafts: Yes   , No X, Number:    Identification:   

Seeps/Springs: Yes X, No   , Number: 1 Identification: Spring located between adit discharge and cabin (SW-2)

Groundwater wells within 4 miles?: Yes X, No   ;  
Number of well logs: 11

Distance to nearest well used for drinking? 1 mile

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite   , Probable   , Possible   , Unlikely X.

Uncontained sources; water pH is neutral and does not contain elevated metals.

Other observations/notes: N/A



**SAMPLERS:** Babits, Flammang, Lasher

[illegible]

FLOW: Estimated (E) or Measured (M) from edit, shaft, seen or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): There was no TDS analysis on 04-144-SW-1; no bottle collected.

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes\_\_\_\_, No X, Name(s):\_\_\_\_\_

\_\_\_\_\_

Dry streambeds: Yes\_\_\_\_, No X, Name(s):\_\_\_\_\_

\_\_\_\_\_

Other surface water: Yes\_\_\_\_, No X, Name(s)/Description:\_\_\_\_\_

\_\_\_\_\_

Waste materials within any floodplain: Yes\_\_\_\_, No X Source ID(s):\_

\_\_\_\_\_

Approximate Flood frequency?\_\_1 yr,\_\_10 yr,\_\_100 yr

Estimated seasonal flow of stream(s) (cfs)? N/A

High Flow:\_\_\_\_\_, Average Flow:\_\_\_\_\_

Distance between waste source(s) and nearest surface water body (ft)?  
N/A

\_\_\_\_\_

Surface water draining onto or through waste sources: Yes X, No\_\_\_\_,  
Describe: Adit discharges onto waste rock; pond on WR-1 most likely  
drains into WR-1.

\_\_\_\_\_

Surface water use within 15 miles downstream? (Drinking water supply, irrigation,  
residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Wetland, fishery, irrigation

\_\_\_\_\_

Observed erosional/sedimentation/stream turbidity problems? Yes X,  
No\_\_\_\_, Distance downstream (ft)? N/A Describe/explain (Note streambank  
stability and condition of streambank vegetation and any manmade structures or channel changes present): \_\_\_\_\_  
Road sedimentation was the only erosion observed.

\_\_\_\_\_

\_\_\_\_\_



## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

#### D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? None

Wetlands present: Yes\_\_\_\_, No X, Describe:\_\_\_\_\_

Carbonate rocks/soils: Yes , No X , Describe:

### E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 X ; 10-30    ; 30-100    ;  
100-300    ; 300-1,000    ; 1,000-3,000    ; 3,000-10,000    ; 10,000 or  
greater    ; Comments   

Nearest residence(ft or miles)? 3 miles

For each source (table next page):

Available fine materials?      Surface area?  
Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
          observed      high      moderate      low      none

# ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

**SAMPLERS:** Babits, Flammang, Lasher

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X, Describe: \_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_; 300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_; Comments None

Evidence of recreational use on site: Yes\_\_\_\_, No X, Describe: \_\_\_\_\_

Accessibility - Fences, warning signs, closed roads? Unrestricted

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment_____
Wilderness Area -	Yes____, No <u>X</u> , Comment_____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment_____
Bat Habitat -	Yes____, No <u>X</u> , Comment_____

Primary Drainage X; Secondary Drainage\_\_\_\_; No Information\_\_\_\_:

Riparian Habitat Quality -	High____, Medium____, Low <u>Not Rated</u>
Wetlands Frontage -	High____, Medium____, Low <u>Not Rated</u>
Fisheries Habitat and Species Classification -	<u>Not Rated</u>
Sport Fishery Classification -	<u>Not Rated</u>

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Hazardous structures: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes X, No\_\_\_\_, Number 1, types and locations: WR-2 slope is at angle of repose and unvegetated.

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain: \_\_\_\_\_

## Bibliography

Johnson, Edward A., Geology and Gold Deposits of the Confederate Gulch, White Gulch Area, Broadwater County, Montana, Thesis for Montana College of Mineral Science and Technology, Butte, Montana, May 1973.

MBMG, Mines and Mineral Deposits (Except Fuels), Broadwater County, Montana, Information Circular 7592, Written by Glenn C. Reed, April 1951.

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB, Abandoned Mine Reclamation Inventory Field Form for Hummingbird, Prepared by Northern Engineering and Testing, June 28, 1988.

USGS, Topographic Map, Whites City, Montana, 7 1/2 minute Quadrangle, 1966.





LABORATORY ANALYTICAL DATA

HUMMINGBIRD  
PA NO. 04-144



Hummingbird PA# 04-144  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BABITS  
INVESTIGATION DATE: 07/26/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
04-144-WR-1	17	157	2.1	10	10.4	49.6	31300	2.17 J	570	39 J	77	5 UJ	87	NR
BACKGROUND	20	98.5	0.8	5.8	11.9	21.6	14100	0.042 J	419	10 J	22	6 UJ	66	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL. ACID/BASE		SULFATE		PYRITIC		ORGANIC		PYRITIC		SULFUR	
	%	1/1000	POTENT.	1/1000	%	1/1000	%	1/1000	%	1/1000	%	1/1000	POTENT.	1/1000
04-144-WR-1	0.31	9.68	39.2	29.5	0.02	0.12	0.17	3.75					35.5	

WATER MATRIX ANALYSES

Metals in Water  
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO <sub>3</sub> /L)
04-144-SW-1	0.96 U	15.3	2.57 U	9.7 U	6.88 U	1.55 U	236	0.12	7.07 J	12.7 U	3.09	30.7 U	7.57 U	231

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry  
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO <sub>3</sub> /NO <sub>2</sub> -N	CYANIDE
04-144-SW-1	NR	NR	NR	0.11	NR

LEGEND

WR1 - Composite of subsamples WR1, 2, 3 and 4.  
BACKGROUND - 50 feet up from adit #1 from Hummingbird Mine (04-144\_SS-1).



**XRF ANALYSIS RESULTS**

**HUMMINGBIRD  
PA NO. 04-144**





XRF Field Analyses

Results in PPM

XRF SAMPLE ID	CHI	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
04-144-SS-1		11745.6	10753.9	1355.26		365.731 *	20527.3		120.324 *	304.377		204.343
04-144-WR-1	446.093 *	13179.6	23719.6	1592.97		907.277 *	40619.8		113.85 *-?????			218.745
04-144-WR-1-COMP		19010.3	15359.6	1731.09		767.837 *	47211.6					191.938
04-144-WR-2		22822.4	1608.95	428.015 *		987.167 *	52064.9		117.423 *	61.6348 *		121.512
04-144-WR-3		19310.1	5823.5	1700.8		1379.93	39872.6		82.0779 *	66.0212 *		193.203
04-144-WR-4		15381.3	6293.8	1536.55			45829.5	374.747 *				64.6018
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
04-144-SS-1	130.181				102.763			358.491		14.6917 *	7.94572 *	
04-144-WR-1	123.71		10.3322 *		107.805			340.638	91.1789 *		10.7877 *	
04-144-WR-1-COMP	141.756		32.6017	102.412	123.626			561.149	118.262 *			
04-144-WR-2	129.901		53.1742	248.192	89.8635			825.624				
04-144-WR-3	160.541		21.598	150.755	115.927			809.178	129.005 *	16.1355 *	7.702 *	
04-144-WR-4	100.522		8.06518 *		114.045			294.687		12.8409 *	11.3696 *	

\* - Estimated Quantity

\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

HUMMINGBIRD  
PA NO. 04-144



# AIMSS SCORESHEET

SITE NAME:

HUMMINGBIRD

PA NUMBER:

04-144

LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.863
6		WELLS - 1 MI. x 2.5		2.5
7	GW - TARGETS	WELLS - 1 TO 4 MI		10
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	12.5
10		<b>GROUNDWATER SCORE</b>	<b>LINES 4 x 5 x 9</b>	<b>2158</b>
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		0
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		2
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	40
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	40
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.938
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		10
19	SW - TARGETS	FISHERY		0
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	17
24		<b>SURFACE WATER SCORE</b>	<b>LINES 14 x 15 x 23</b>	<b>638</b>
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		10
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	50
27		LIKELIHOOD SCORE	LINES 25 + 26C	50
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.001
29		POPULATION - 4 MILES		1
30		NEAREST RESIDENCE		0
31	AIR - TARGETS	WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	1
35		<b>AIR PATHWAY SCORE</b>	<b>LINES 27 x 28 x 34</b>	<b>0</b>
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		0
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	100
38		LIKELIHOOD SCORE	LINES 36 + 37C	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.001
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		0
41		NEAREST RESIDENCE		0
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 - 42	0
44		<b>DIRECT CONTACT SCORE</b>	<b>LINES 38 x 39 x 43</b>	<b>0</b>
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			<b>0.03</b>
	(LINES 10 + 24 + 35 + 44) / 100,000			

	SITE NAME: HUMMINGBIRD		
	PA NUMBER: 04-144		
LINE NO.			
1	SITE SAFETY		
2	THREAT	ACCESSIBILITY	20
3	HAZARDS	OPEN SHAFTS	100 EA.
4		OPEN ADITS	50 EA.
5		UNSTAB. HIWALLS / PITS	75 EA.
6		HAZ. STRUCTURES	40 EA.
7		EXPLOSIVES	
8		HAZ. MATERIALS	
9		HAZARDS SCORE	SUM LINES 2 - 7
10	TARGETS	POPULATION - 1 MILE	
11		NEAREST RESIDENCE	
12		RECREATIONAL USE	
13		TARGETS SCORE	SUM LINES 9 - 11
	SITE SAFETY SCORE		(LINES 1 x 8 x 12) / 1,000

SITE NAME:

HUMMINGBIRD

PA NUMBER:

04-144







MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: ARGO MINE AND MILLSITE PA#: 04-015

Date: July 26, 1993 Time: 1000-1500

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Clark, Pioneer  
Pierson, TD&H

Visitors: None

Weather/Seasonality Observations: Moderate to hard rain; approx.  
55° F; cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #2: WR-1. No video  
was taken due to rain.

General Comments/Observations (not covered specifically in attached Inventory Forms):  
N/A

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Remove  
tailings from drainage; stabilize, amend, and revegetate dumps.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): ARGO MINE AND MILLSITE PA#: 04-015

Legal Description: T 11N ; R 1E ; Sec. 27 , NW1/4NE 1/4 1/4

County: BROADWATER Mining District: HELLGATE

Latitude: N 46° 41' 16" Longitude: W 111° 33' 52"

Primary Drainage Basin and Code: Missouri River/10030101

Secondary Drainage Basin: Hellgate Gulch

USGS Quadrangle map name(s): Hellgate Gulch

Mine Type/Commodities: Hardrock/Copper

Activity Status: Active      , Inactive/Exploration      , Abandoned X .

Ownership status: Known YX N ; private/public? Private/Public  
Owner, Agent, or Contact (Include address and phone when available): Argo, Inc., c/o  
Mary Ann Mangon, P.O. Box 5567, Helena, MT 59604; Helena National  
Forest.

Relationship to other mines/sites in the area/district: Unknown

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 5200' , Slope 4° in  
bottom, Aspect Southern

Land use: Mining      , Recreational X , Residential      , Urban      ,  
Agricultural X , Other(Specify)     

Area of disturbed/unvegetated lands? 1.7 acres.  
Dimensions:     

Predominant vegetation types: Douglas fir, juniper, wild rose,  
willow

Access: roads - good      , poor      , 4wd X , trail      .  
Other logistical considerations (proximity to other sites). Access  
is probably good with dry conditions.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). The principal rocks are shales and  
limestones of the Spokane, Greyson, Helena, and Newland formations.  
The Belt rocks are cut by intrusive dikes of diorite and quartz  
diorite which are associated with the ore body. Site lies near the  
confluence of Harris Gulch and Hellgate Gulch. Harris Gulch flows  
southeast to confluence with Hellgate Gulch, which flows north to  
northeast away from site.

Mining/milling history, ore type/tenor, host rock, gangue: The  
Argo mine produced 5,831 tons of ore averaging 25.7% copper. Ore  
consists of ankerite, quartz, and chalcopyrite.

#### Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 6, Comment 1 open with grate door;  
remaining are caved.  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

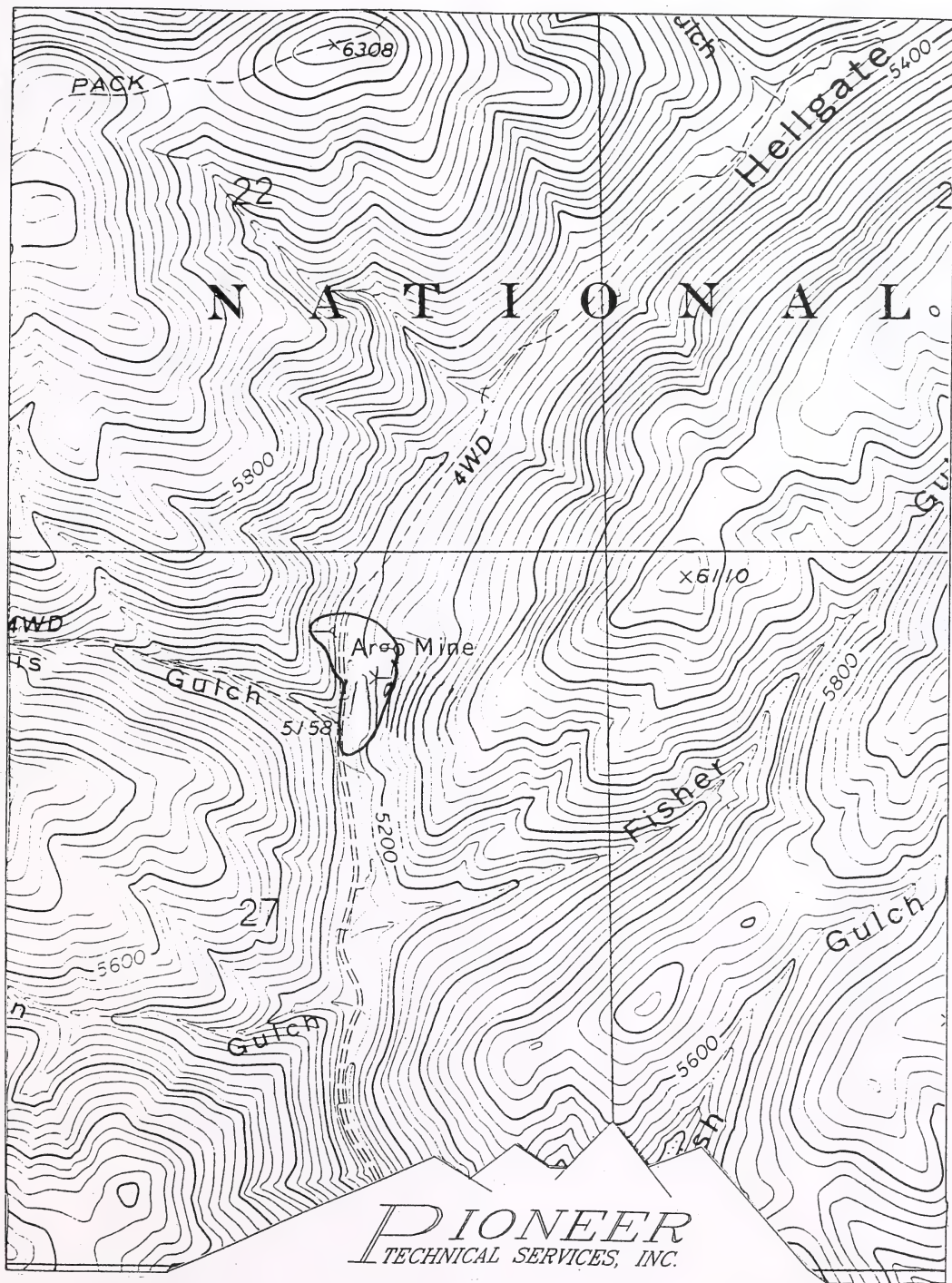
Mill Operation? Yes X, No     . If yes answer the next three  
questions:

Period(s) of Operation: Most development work was done during WWI.

Origin of Ore Milled - Custom Mill      Dedicated Mill X; Number and  
names of mines that supplied mill feed: Unknown

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
Gravity





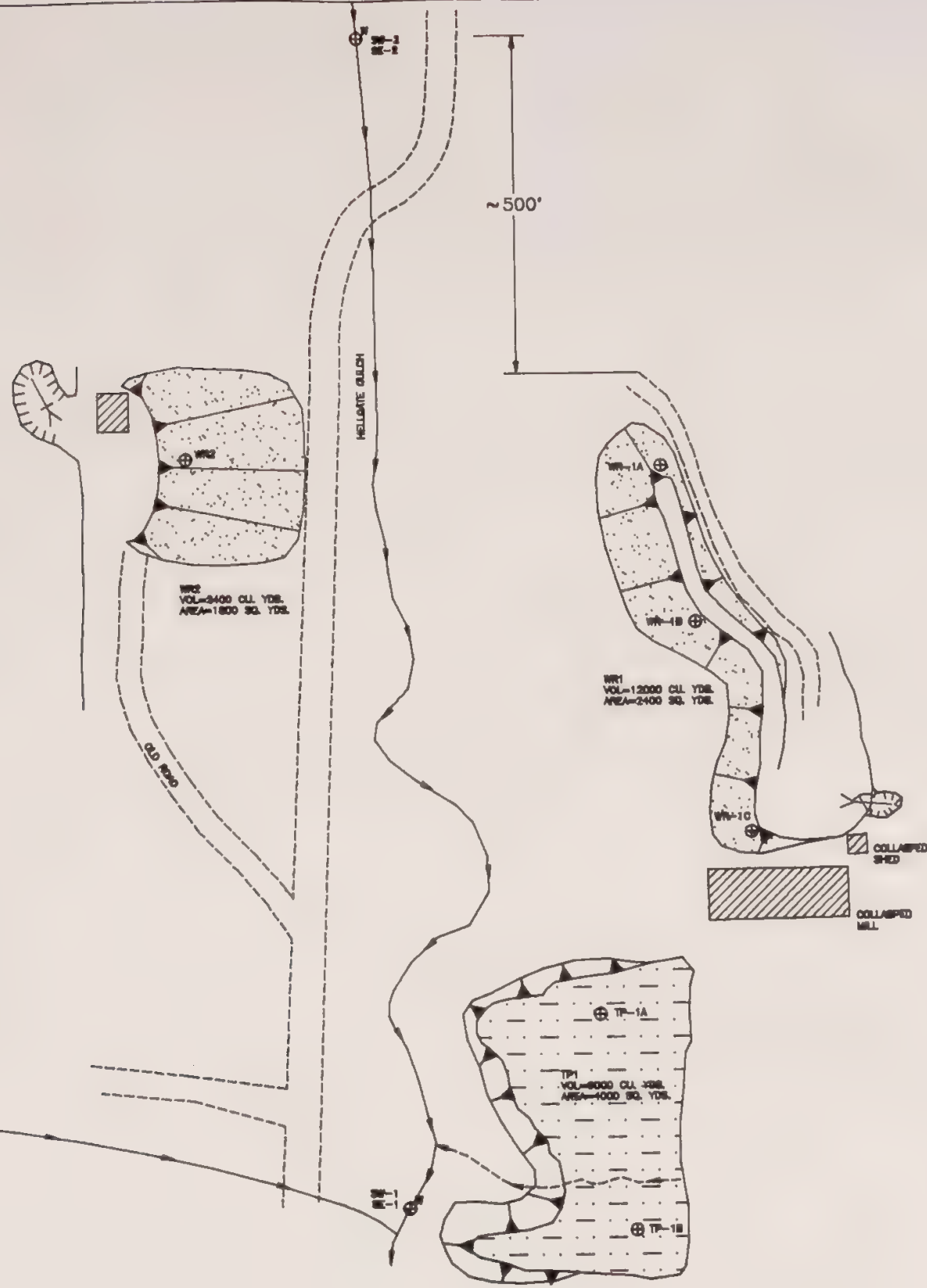
*PIONEER*  
TECHNICAL SERVICES, INC.

ARGO, P.A. NO. 04-015

T11N, R01E, SECTION 27

SCALE: 1" = 1000'



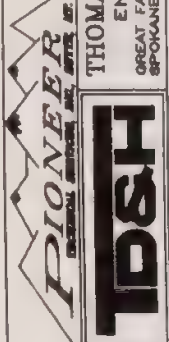


SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
---	CULVERT	---	OPEN ADT
*	LIGHT (LIGHT POLE)	---	COLLAPSED ADT
•	UTILITY POLE	---	OPEN SHAFT
•	DECIDUOUS TREE	---	COLLAPSED SHAFT
•	CONIFEROUS TREE	---	DRAWING
---	WOOD FENCE	---	WASTE ROCK DUMP
---	WIRE FENCE	---	COLLAPSED TIMBERS
---	BUILDING	---	RAILS
•	BARRIER POST	---	SOIL SAMPLE
---	ORTE	---	XRF SAMPLE
---	EDGE OF ASPHALT	---	WATER SAMPLE
---	EDGE OF GRAVEL	---	GROUND AND SURFACE
---	SLOPE DIRECTION	---	DRAINAGE
---	TAILINGS POND	---	WATER WELL
		---	PONDED WATER
		---	VEGETATED WET LANDS



MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

ARGO PA# 04-015  
HELLGATE DISTRICT BROADWATER COUNTY



THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON SPOKANE

DRAWN TWC DATE 1 DEC 83  
DESIGNED TPR JOB NO. 83-17  
APPROVED INJB F.B. NO.

SHEET NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
Angular pebbles with approx. 10% clay.

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Tailings deposit is 7 feet thick on the north end near mill and 13 feet at the dam area.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Wet;  
due to coarse nature of tailings and intense precipitation; could not  
determine whether groundwater was contacting tailings.

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Tailings are being actively eroded by Hellgate Gulch stream.

Comments on potential for mitigation: Remove tailings from floodplain;  
regrade, amend, and revegetate.





**SOURCE INVENTORY FORM**

**SAMPLERS:** Bullock, Tailings; Pierson, Waste Rock

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	pH SU (D/S)*	RADIO-ACTIVITY (MR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
TP-1A-A	TAIL	9,000	North end near mill; 0'-1', brown shale	None	6.2 (D)	0.04	04-015-TP-1	07/26/93 1400	T-Metals, ABA
TP-1A-B	TAIL		North end near mill; 1'-4', tan shale with Cu staining	None	6.0 (D)	0.04			
TP-1A-C	TAIL		North end near mill; 4'-7.5', brown shale with Cu staining	None	5.9 (D)	0.04			
TP-1B-A	TAIL		Southeast end; 0'-4', green/gray shale	None	6.0 (D)	0.06			
TP-1B-B	TAIL		Southeast; 4'-4.5', gray tight clay	None	6.0 (D)	0.05			
TP-1B-C	TAIL		Southeast; 4.5'-10', brown shale	None	6.0 (D)	0.05			
WR-1A	WR	12,000	North end of dump, near top	None	6.4 (D)	0.04	04-015-WR-1	07/26/93 1415	T-Metals, ABA
WR-1B	WR		Middle of dump, near top	None	6.7 (D)	0.05			
WR-1C	WR		Near mill, south end of dump, near top	None	6.0 (D)	0.05	N/A	N/A	XRF Analysis
WR-2	WR	2,400	Dump located west of Hellgate Gulch	None	3.9 (D)	0.04			
SS-1	BKGRND	N/A	Background soil	N/A	5.9 (D)	0.07	04-015-SS-1	07/26/93 1400	T-Metals

\*D-Direct reading (Kilovolt Meters); B-Depleted Beta (Orion Meter)

**Comments or deviations from SOPs:** 04-015-WR-1 is composite of WR-1A and -1B, and WR-2A. 04-015-TP-1 is composite of TP-1A-A through -1A-C, and TP-1B-A through -1B-C.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes\_\_\_, No X, Number:\_\_\_ Identification: Water ponded in bottom of adit appears to be precipitation ponding.

Filled shafts: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Seeps/Springs: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Groundwater wells within 4 miles?: Yes X, No\_\_\_;  
Number of well logs: 69

Distance to nearest well used for drinking? 3 miles (downgradient well)

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite\_\_\_, Probable\_\_\_, Possible X, Unlikely\_\_\_.

Site does not appear to have any significant groundwater contamination problems.

Other observations/notes: N/A

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): Hellgate Gulch Creek and Harris Gulch stream

Dry streambeds: Yes     , No X, Name(s):                     

Other surface water: Yes     , No X, Name(s)/Description:                     

Waste materials within any floodplain: Yes X, No      Source ID(s): WR-1 and TP-1

Approximate Flood frequency? X 1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)?                     

High Flow: 8 cfs, Average Flow: 0.5 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet to TP-1

Surface water draining onto or through waste sources: Yes X, No     , Describe: Stormwater runoff observed flowing off of tailings directly into Hellgate Gulch Creek.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Irrigation

Observed erosional/sedimentation/stream turbidity problems? Yes X, No     , Distance downstream (ft)? 1000 Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):  
Minor amounts of tailings at the 1000' sediment sample location; bank erosion is occurring, but may be partially attributed to cattle grazing.



# **SURFACE WATER INVENTORY FORM**

SAMPLERS: Bullock, Pierson

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	PH SU	SC µS/cm @ 25°C	Eh mV	Temp °C	ALK. mg/L as CaCO <sub>3</sub>	Flow* cfs/gpm	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
SW-1	SW	Downgradient from most of the site, but upgradient of Harris Gulch confluence	8.58	560	188	NM	241	3.1 cfs (M)	04-015-SW-1	07/26/93 1230	T-Metals, TDS, Hardness, Cl, SO <sub>4</sub> , NO <sub>2</sub> /NO <sub>3</sub>
SE-1	SE	Downgradient from most of the site, but upgradient of Harris Gulch confluence	N/A	N/A	N/A	N/A	N/A	N/A	04-015-SE-1	07/26/93 1230	T-Metals
SW-2	SW	Upgradient of site; 200 feet above trail head	8.4	560	211	NM	236	4.9 cfs (M)	04-015-SW-2	07/26/93 1300	T-Metals, TDS, Hardness, Cl, SO <sub>4</sub> , NO <sub>2</sub> /NO <sub>3</sub>
SE-2	SE	Upgradient of site; 200 feet above trail head	N/A	N/A	N/A	N/A	N/A	N/A	04-015-SE-2	07/26/93 1300	T-Metals
SE-500	SE	500 feet below SE-1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	XRF Analysis
SE-1000	SE	1,000 feet below SE-1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	XRF Analysis

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): SW-1 was not collected downgradient of all the tailings because of stormwater runoff from Harris Gulch which did not warrant separate characterization. NM = Not Measured

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? Approx. 10 acres of broad floodplain

Wetlands present: Yes     , No X, Describe:                                     

Carbonate rocks/soils: Yes X, No     , Describe: Madison limestone

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10     ; 10-30 X; 30-100     ;  
100-300     ; 300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or  
greater     ; Comments                                     

Nearest residence(ft or miles)? 1.6 miles in adjacent drainage

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



SAMPLERS: Bullock, Pierson

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X  
Describe:

Population within 1 mile: 1-10\_\_\_; 10-30\_\_\_; 30-100\_\_\_; 100-300\_\_\_;  
300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or greater\_\_\_;  
Comments None

Evidence of recreational use on site: Yes X, No     , Describe: Off-road vehicle tracks; campfire rings; fireworks

Accessibility - Fences, warning signs, closed roads? Unrestricted

**Sensitive environments on-site or adjacent to site:**

State or National Parks - Yes\_\_\_, No X, Comment \_\_\_\_\_  
 Wilderness Area - Yes\_\_\_, No X, Comment \_\_\_\_\_  
 T&E Species Habitat - Yes\_\_\_, No X, Comment \_\_\_\_\_  
 Bat Habitat - Yes X, No \_\_\_, Comment Adit #1 \_\_\_\_\_

Primary Drainage ; Secondary Drainage X ; No Information :

Riparian Habitat Quality -	High___, Medium___, Low___	Not Rated
Wetlands Frontage -	High___, Medium___, Low___	Not Rated
Fisheries Habitat and Species Classification -		Not Rated
Sport Fishery Classification -	Not Rated	

## G. SAFETY CHARACTERISTICS

## Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No     , Number 1, types and locations:       
Adit #1 is gated, but not locked.

Hazardous structures: Yes X, No   , Number 2, types and locations: Mill and cabin at WR-2.

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_, No X, Number\_\_\_,  
types and locations:

Unstable waste piles, impoundments, undercut banks: Yes X, No     ,  
Number 3 , types and locations: TP-1, WR-1, and WR-2

Fire and/or Explosion hazards: Yes ☐ , No ☒ , Explain:

## Bibliography

- MBMG, Argo, Rex, Copper Queen Group, Broadwater County, Montana, Form 39, 1972, 1974, and 1975.
- MBMG, Well Log Database, September 8, 1993.
- MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.
- MBMG, Geology of the Canyon Ferry Quadrangle, Montana, Bulletin 972, Author Unknown, Date Unknown, p. 62.
- MDSL/AMRB Files, Abandoned Mine Reclamation Portal Inventory for Argo, Prepared by Daphne Digrindakis, September 14, 1984.
- MDSL/AMRB Files, Department of Interior, Office of Surface Mining, Abandoned Mine Lands Inventory Update Form, Prepared by Daphne Digrindakis, November 20, 1984.
- USGS, Topographic Map, Hellgate Gulch, Montana, 7 1/2 minute Quadrangle, 1972.



LABORATORY ANALYTICAL DATA

ARGO MINE AND MILLSITE  
PA NO. 04-015





Argo PA# 04-015  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 07/26/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
04-015-SE-1	11	33.7	0.9	4.3	6.9	2240	15400	0.013 J	299	12 J	22	6 UJ	42	NR
04-015-SE-2	8	39.7	0.9	5.4	5.9	14.8	14900	0.017 J	244	12 J	19	6 UJ	54	NR
04-015-TP-1	5	35.6	1.4	4.4	3.1	7810	18000	0.562 J	286	8 J	30	7 UJ	25	NR
04-015-WR-1	14	34.1	2.2	6.8	5.2	58200	55100	0.511 J	201	31 J	59	6 UJ	40	NR
BACKGROUND	16	225	0.6	4.7	4.5	52.4	8640	0.023 J	410	5 J	14	7 UJ	39	NR

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR			SULFUR ACID BASE			PYRITIC SULFUR			ORGANIC SULFUR			PYRITIC ACID BASE			SULFUR ACID BASE POTENTIAL		
	%	U/1000t	U/1000t	%	POTENTIAL	U/1000t	%	POTENTIAL	U/1000t	%	POTENTIAL	U/1000t	%	POTENTIAL	U/1000t	%	POTENTIAL	U/1000t
04-015-TP-1	0.99	30.9	77.9	47.0	<0.01	0.04	0.97	1.25	76.6	1.06	6.87	56.0	0.04	0.97	1.25	76.6	1.06	6.87
04-015-WR-1	1.14	35.6	62.9	27.3	<0.01	0.22	1.06	6.87	56.0	1.06	6.87	56.0	0.22	1.06	6.87	56.0	1.06	6.87

WATER MATRIX ANALYSES

Metals in Water  
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
04-015-SW-1	0.96 U	29.6	2.57 U	9.7 U	6.83 U	22.9	388	0.09	14.8 J	12.7 U	3.34	30.7 U	7.57 U	318
04-015-SW-2	0.96 U	25.5	2.57 U	9.7 U	6.83 U	1.55 U	220	0.14	10.2 J	12.7 U	2.45	30.7 U	7.57 U	314

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Requested

Wet Chemistry  
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
04-015-SW-1	380	< 5.0	59	< 0.05	NR
04-015-SW-2	349	5.7	53	< 0.05	NR

LEGEND

SE1 - Downgradient from most of the site, but upgradient of Harris Gulch confluence.  
SE2 - Upgradient of site, 200' above trail head.  
TP1 - Composite of subsamples TP1-A, 1A-B, 1A-C, 1B-A, 1B-B, and 1B-C.  
WR1 - Composite of subsamples WR1A, 1B, and 2A.  
BACKGROUND - From the Argo (04-015-SS-1).

SW1 - Same as sample SE1.  
SW2 - Same as sample SE2.



XRF ANALYSIS RESULTS

ARGO MINE AND MILLSITE  
PA NO. 04-015



## XRF SAMPLE ID:

\* – Estimated Quantity  
\$ – Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

ARGO  
PA NO. 04-015



# **AIMSS SCORESHEET**

SITE NAME: ARGO MINE AND MILL  
PA NUMBER: 04-015

LINE NO.			
<b>GROUNDWATER PATHWAY</b>			
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	20
3B		GW DEPTH	10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B 200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C 200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET) 0.799
6	GW - TARGETS	WELLS - 1 MI. x 2.5	0.0
7		WELLS - 1 TO 4 MI	69
8		NEAREST WELL	0
9		TARGETS SCORE	LINES 6 + 7 + 8 69.0
10		<b>GROUNDWATER SCORE</b>	LINES 4 x 5 x 9 11026
<b>SURFACE WATER PATHWAY</b>			
11		OBSERVED RELEASE	300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES	0
13A		CONTAINMENT	20
13B		DISTANCE TO SW	20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B 400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C 700
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET) 7.398
16	SW - TARGETS	DRINKING WATER POP'N	0
17		IMPACTED DRAINAGE	1
18		WETLANDS	0
19		FISHERY	0
20		RECREATION	0
21		IRRIGATION/STOCK	2
22		T & E SPECIES HABITAT	0
23		TARGETS SCORE	SUM LINES 16 - 22 3
24		<b>SURFACE WATER SCORE</b>	LINES 14 x 15 x 23 15536
<b>AIR PATHWAY</b>			
25		OBSERVED RELEASE	0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT	1
26B		DISTANCE TO POPULATION	5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B 5
27		LIKELIHOOD SCORE	LINES 25 + 26C 5
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET) 0.082
29	AIR - TARGETS	POPULATION - 4 MILES	10
30		NEAREST RESIDENCE	0
31		WETLANDS	0
32		PARKS / WILDERNESS	0
33		T & E SPECIES HABITAT	0
34		TARGETS SCORE	SUM LINES 29 - 33 10
35		<b>AIR PATHWAY SCORE</b>	LINES 27 x 28 x 34 4
<b>DIRECT CONTACT PATHWAY</b>			
36		OBSERVED EXPOSURE	50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY	20
37B		DISTANCE TO POPULATION	5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B 100
38		LIKELIHOOD SCORE	LINES 36 + 37C 150
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET) 0.009
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE	0
41		NEAREST RESIDENCE	0
42		RECREATIONAL USE	10
43		TARGETS SCORE	SUM LINES 40 - 42 10
44		<b>DIRECT CONTACT SCORE</b>	LINES 38 x 39 x 43 14
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b> (LINES 10 + 24 + 35 + 44) / 100,000		0.27

LINE NO.				SITE NAME:	ARGO MINE AND MILL
				PA NUMBER:	04-015
	<b>SITE SAFETY</b>				
1	THREAT	ACCESSIBILITY			20
2		OPEN SHAFTS	100 EA.		0
3		OPEN ADITS	50 EA.		50
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.		0
5		HAZ. STRUCTURES	40 EA.		80
6		EXPLOSIVES			0
7		HAZ. MATERIALS			0
8		HAZARDS SCORE	SUM LINES 2 - 7		130
9		POPULATION - 1 MILE			0
10	TARGETS	NEAREST RESIDENCE			0
11		RECREATIONAL USE			10
12		TARGETS SCORE	SUM LINES 9 - 11		10
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>		<b>26.00</b>



04-015, #2: WR-1









MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: PARK PA#: 04-012

Date: July 27, 1993 Time: 0800-1500

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Pierson, TD&H  
Clark, Pioneer

Visitors: None

Weather/Seasonality Observations: Partly cloudy; light winds;  
cool (approx. 60°F); cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #6: WR-8, Adit; #7:  
Remains of old mill below WR-8; #8: Shaft at WR-1; #9: WR-1; #10:  
WR-2 loadout and mill; #11: WR-4 foreground, WR-6 background; #12:  
GW-1, Adit #2; #13: Adit #9 discharge; #14: WR-9; #15: Adit #4;  
#16: SW-3. Video Tape No. 4

General Comments/Observations (not covered specifically in attached Inventory Forms): N/A

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Isolate  
wastes from drainages, amend, and revegetate.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): PARK PA#: 04-012

Legal Description: T 7N ; R 1W ; Sec. 15 , NE1/4 NE1/4 1/4

County: BROADWATER Mining District: INDIAN CREEK

Latitude: N 46° 21' 53" Longitude: W 111° 42' 21"

Primary Drainage Basin and Code: Indian Creek/10030101

Secondary Drainage Basin: Indian Creek

USGS Quadrangle map name(s): Giant Hill

Mine Type/Commodities: Hardrock/Gold, Lead, Silver

Activity Status: Active      , Inactive/Exploration X ; 1,8 ,  
Abandoned X ; 2-6,7,9 .

Ownership status: Known YX N ; private/public? Private/Public  
Owner, Agent, or Contact (Include address and phone when available): Thomas W. and  
Mary A. Cotter, 741 Center Drive, Palo Alto, CA 94301. (406)  
321-1102; Helena National Forest.

Relationship to other mines/sites in the area/district: Many other  
adits and explorations in the drainage downgradient of this site.  
Area is known as Park Area, which contains Marietta, Park, Little  
Annie, and Gold Dust mines.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 6800'-7400' , Slope 5°-25° ,  
Aspect Southwestern

Land use: Mining      , Recreational X , Residential      , Urban      ,  
Agricultural      , Other (Specify)     

Area of disturbed/unvegetated lands? 2.5 acres.  
Dimensions:     

Predominant vegetation types: Douglas fir, Lodgepole pine, alder,  
willows, grasses

Access: roads - good X , poor      , 4wd      , trail      .  
Other logistical considerations (proximity to other sites).

Well logs within 1 mile radius; water rights 15 mi downstream (Attach MBWG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Site lies in headwaters of Indian Creek. Water leaving the site flows down Indian Creek to the southeast. Ore deposits are in andesite near quartz monzonite intrusives.

Mining/milling history, ore type/tenor, host rock, gangue: Mining began in the 1880s to 1908 and from 1933 to 1945. Marietta mine showed limited production through 1966. Fracture filling and replacement in andesite. Predominant vein minerals are pyrite, arsenopyrite, galena, sparse sphalerite in a silicified andesite gangue; quartz gangue, also manganiferous carbonate mineral.

Mine Operation?

Shafts - Yes X, No     , # 4, Comment 3 caved; 1 open  
Adits - Yes X, No     , # 7, Comment 5 closed; 2 open  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

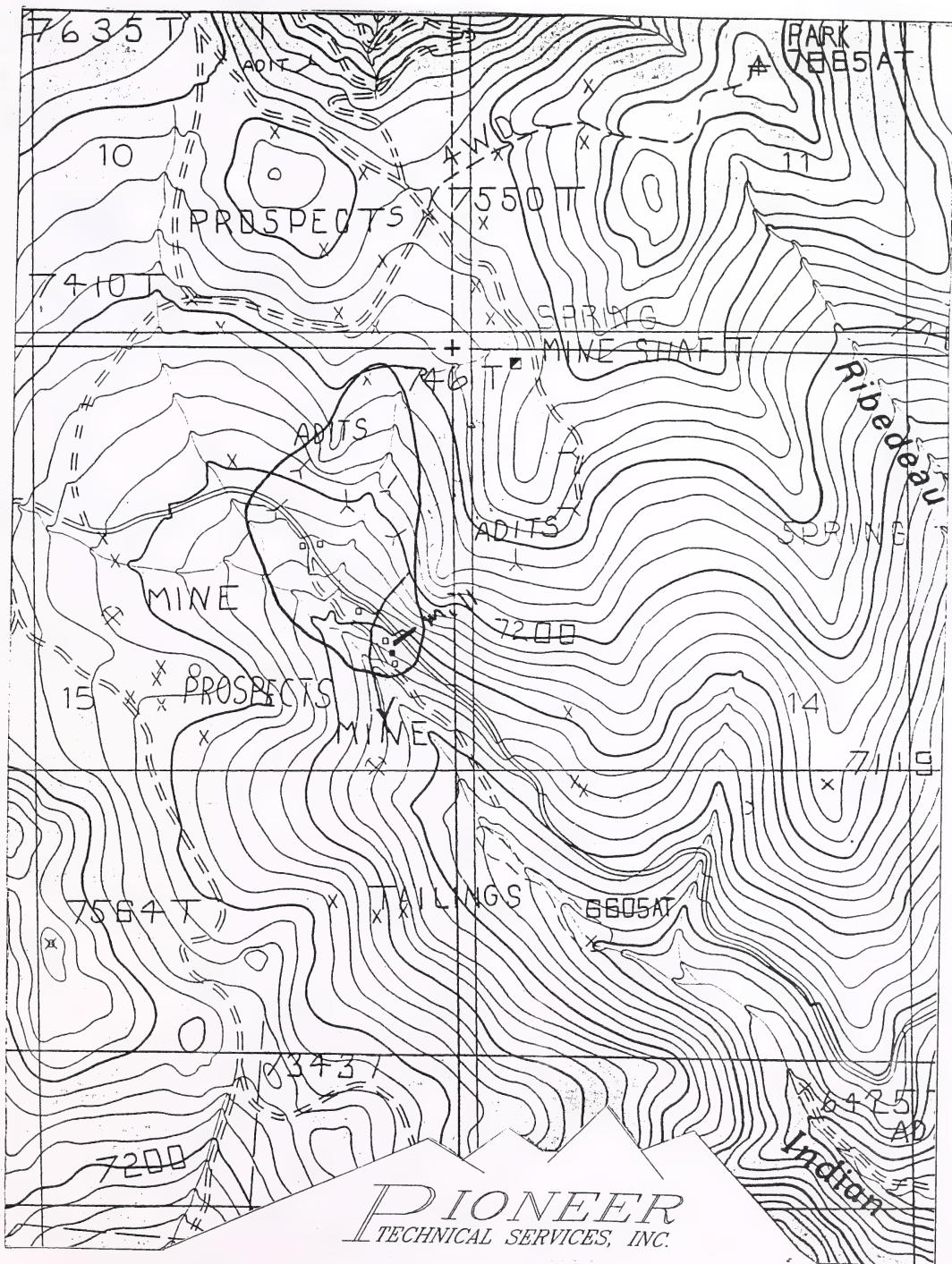
Mill Operation? Yes X, No     . If yes answer the next three questions:

Period(s) of Operation: 1906 to Unknown

Origin of Ore Milled - Custom Mill      Dedicated Mill X; Number and names of mines that supplied mill feed: Unknown

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
CN- vat leach





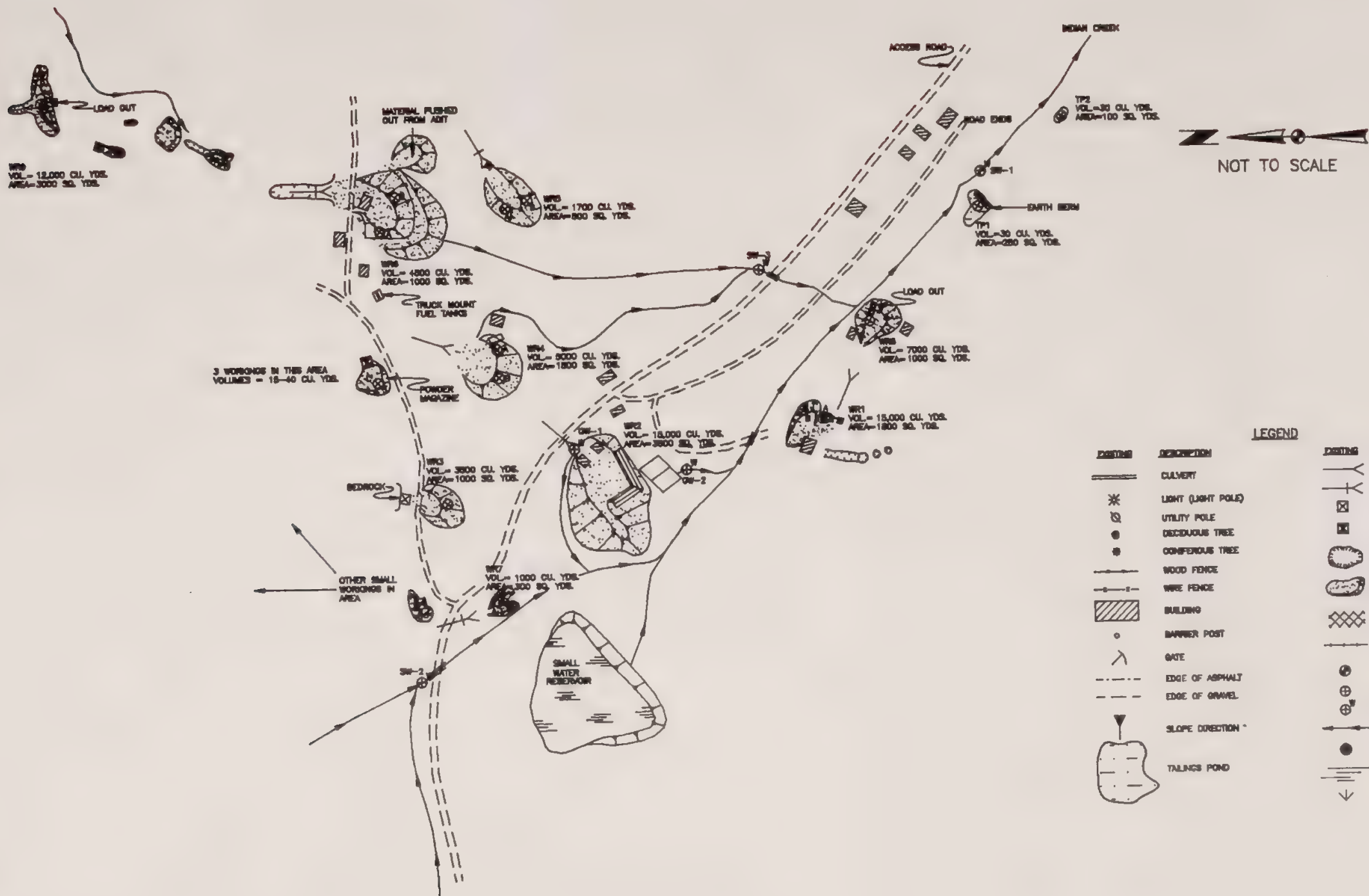
**PIONEER**  
TECHNICAL SERVICES, INC.

PARK, P.A. NO. 04-012

T07N, R01W, SECTION 15

SCALE: 1" = 1000'





MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

PARK PA# 04-012  
INDIAN CREEK DISTRICT BROADWATER COUNTY

**PIONEER**  
ENGINEERING CONSULTANTS

**TDSH**

DRAWN: JTP DATE: 3 DEC. 93  
DESIGNED: JTR JOB NO. 93-17  
APPROVED: NUB F.B. NO.

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON

SHEET NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
Medium (50%) to coarse (50%) yellow sand

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Thin deposits - all oxidized

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): All tailings located were wet.

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): No impoundments remaining.

Comments on potential for mitigation: Small volumes could easily be removed from drainages.



## SOURCE INVENTORY FORM

SAMPLERS: Bullock, Pierson\*

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	PH SU (D/S)*	RADIO-ACTIVITY (MR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
WR-1A	WR	15,000	South side of mill and creek; brown silty sand	None	6.4 (D)	0.03	04-012-WR-1	07/27/93 1715	T-Metals, ABA
WR-1B	WR		East end of WR-1; silty sand	None	6.4 (D)	0.04			
WR-2A	WR	15,000	South of loadout	None	< 3.5 (D)	0.04			
WR-2B	WR		Adjacent to south side of loadout	None	6.6 (D)	0.04			
WR-2C	WR		North end of dump; tan silty sand	None	5.0 (D)	0.04			
WR-3A	WR	3,500	North of WR-2 associated with shaft	None	6.7 (D)	0.03	04-012-WR-2	07/27/93 1735	T-Metals, ABA
WR-4A	WR	5,000	Northeast end of WR-2, west of loadout; up eastern tributary	None	5.7 (D)	0.04			
WR-4B	WR		Southwest side of dump	None	4.8 (D)	0.04			
WR-4C	WR	40	North of WR-4A	None	5.9 (D)	0.04			
WR-5A	WR	1,700	East of WR-4, up eastern tributary; west side	None	6.4 (D)	0.04			
WR-5B	WR		East side of WR-5	None	6.8 (D)	0.04	N/A	N/A	XRF Analysis
WR-6A	WR	4,500	North of WR-5, south of loadout, up eastern tributary; east side	None	5.8 (D)	0.03			
WR-6B	WR		Southeast side of WR-6	None	4.8 (D)	0.05			
WR-7A	WR	1,000	Associated with adit west of WR-3	None	< 3.5 (D)	0.04			
WR-8A	WR	7,000	Downstream of WR-1, north end near stream	None	6.8 (D)	0.04	04-012-WR-3	07/27/93 1855	T-Metals, ABA
WR-9A	WR	12,000	Upper most significant working, north of WR-6	None	< 3.5 (D)	0.04			

\*D-Direct reading(Kelway Meter); S-Saturated Paste(Orion Meter)

Comments or deviations from SOPs: 04-012-WR-1 is composite of WR-1A and -1B, and WR-2A through -2C. 04-012-WR-2 is composite of WR-3A, WR-4A through -4C, WR-5A, WR-6A and -6B, WR-7A, and WR-9A. 04-012-WR-3 is grab of WR-8.

\*Continued on next page



SAMPLERS: Bullock, Pierson

[illegible]

D-Direct reading (Railway Meter); B-Saturated Paste (Orion Meter)

Comments or deviations from SOPs: 04-012-Tp-1 is composite of Tp-1 and Tp-2.  
NM = Not Measured.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map.

Flowing adits: Yes X, No     , Number: 3 Identification: Adit at WR-2 (GW-1); Adit at WR-9; Adit at WR-4

Filled shafts: Yes     , No X, Number:      Identification:     

Seeps/Springs: Yes X, No     , Number: 2 Identification: Seep below mill (GW-2); seep into water reservoir

Groundwater wells within 4 miles?: Yes X, No     ;  
Number of well logs: 16

Distance to nearest well used for drinking? Approx. 1.5 miles

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite X, Probable     , Possible     , Unlikely     .

Contaminated discharges, as well as reactive wastes in contact with water which percolates into the ground.

Other observations/notes: N/A

**SAMPLERS:** Bullock, Clark

[illegible]

**FLOW:** Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): NM = Not measured.

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map of topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): Indian Creek and small perennial tributary to Indian Creek

Dry streambeds: Yes     , No X, Name(s):     

Other surface water: Yes X, No     , Name(s)/Description: Flow from adit discharge and seep as well as upgradient pond in stream channel.

Waste materials within any floodplain: Yes X, No      Source ID(s): WR-1, WR-2, WR-6, WR-7, WR-8, TP-1, and TP-2

Approximate Flood frequency? X 1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)? 3.0 during investigation  
High Flow: 25 cfs, Average Flow: 3.0 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet for WR-1, WR-2, WR-8, and TP-1.

Surface water draining onto or through waste sources: Yes X, No     ,  
Describe: Adit discharge over/through WR-2, WR-4, WR-6, and WR-9.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Stock watering, irrigation, fishery, wetlands, T&E - Bald Eagle

Observed erosional/sedimentation/stream turbidity problems? Yes X, No     , Distance downstream (ft)? >1000 Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Mines/mine waste in drainage several miles below the Park mines.



**SAMPLERS:** Bullock, Clark

FLOW: Estimated (E) or Measured (M)?

MDSL AMRB/PIONEER 4/9/93

#### D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? Approx. 3 to 4 acres at the mine site and a large area of approx. 30 acres 0.75 miles below the mine.

Wetlands present: Yes , No X , Describe:

Carbonate rocks/soils: Yes X, No     , Describe: Carbonates reported  
in gangue mineralization.

### E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10\_\_\_; 10-30 X; 30-100\_\_\_;  
100-300\_\_\_; 300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or  
greater\_\_\_; Comments

Nearest residence(ft or miles)? Recreation residence < 1/2 mile from the site.

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



# ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Bullock, Pierson

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH /MODERATE/LOW/MORE)
TP-1	ESD	Partial	2,250	2,250	Yes	Low
TP-2	Low pH; ESD	Dry	900	900	Yes	Low
WR-1	None	Dry	16,200	15,370	Yes	Low
WR-2	Sulfides; low pH	Partial	31,500	31,500	Yes	Low
WR-3	Sulfides	Dry	9,000	8,550	Yes	Low
WR-4	Sulfides; low pH	Partial	13,500	12,825	Yes	Low
WR-5	None	Dry	4,500	4,275	Yes	Low
WR-6	Low pH	Partial	9,000	8,100	Yes	Low
WR-7	Low pH	Dry	2,700	2,160	Yes	Low
WR-8	None	Partial	9,000	7,650	Yes	Low
WR-9	Low pH	Partial	27,000	18,900	Yes	Low
GW-1	Low pH; FEOX; algae	N/A	N/A	N/A	N/A	N/A
GW-2	Low pH; algae	N/A	N/A	N/A	N/A	N/A
GW-3	Slight FEOX	N/A	N/A	N/A	N/A	N/A

Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe: \_\_\_\_\_

Population within 1 mile: 1-10 X; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments \_\_\_\_\_

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: Litter;  
off-road vehicle tracks; wood cutters observed. \_\_\_\_\_

Accessibility - Fences, warning signs, closed roads? Unrestricted

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment _____
Wilderness Area -	Yes____, No <u>X</u> , Comment _____
T&E Species Habitat -	Yes <u>X</u> , No____, Comment <u>Bald Eagle</u>
Bat Habitat -	Yes <u>X</u> , No____, Comment <u>Open adits</u>

Primary Drainage\_\_\_\_; Secondary Drainage X; No Information\_\_\_\_:

Riparian Habitat Quality - High\_\_\_\_, Medium X, Low\_\_\_\_  
Wetlands Frontage - High\_\_\_\_, Medium X, Low\_\_\_\_  
Fisheries Habitat and Species Classification - 4  
Sport Fishery Classification - 5

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No\_\_\_\_, Number 3, types and locations:\_\_\_\_  
Adits at WR-8 and at WR-4; shaft at WR-1.

Hazardous structures: Yes X, No\_\_\_\_, Number 16, types and locations:\_\_\_\_  
Various mine/mill structures, office, cabins, and loadouts.

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_,  
types and locations: \_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes X, No\_\_\_\_,  
Number 3, types and locations: WR-1, WR-2, and WR-3 are oversteepened  
and eroding dump face by Indian Creek.

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain: \_\_\_\_\_

## Bibliography

- MBMG, Ore Deposits of the Northern Part of the Park (Indian Creek) District, Broadwater County, Montana, Bulletin No. 35, Written by Elmer M. Schell, June 1963.
- MBMG, Well Log Database, September 8, 1993.
- MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.
- MDHES/WQB, Analytical Data for Park Mine, October 5, 1981.
- MDSL/AMRB Files, Abandoned Mine Lands National Inventory, Phase II Problem Area Data Sheet for the Park mine, Prepared by Les Pederson and Mike Hiel, October 5, 1981.
- MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for the Park/Marietta, Prepared by Northern Engineering and Testing, May 13 and 19, 1988.
- MDSL/AMRB Files, Abandoned Mine Reclamation Portal Inventory for the Park Mines, Prepared by Daphne Digrindakis, October 7, 1986.
- USBM, Mines and Mineral Deposits (Except Fuels), Broadwater County, Montana, Information Circular 7592, Written by Glen C. Reed, April 1951.
- USGS, Geology and Mineral Deposits, East Flank of the Elkhorn Mountains, Broadwater County, Montana, Professional Paper 665, Author Unknown, Date Unknown.
- USGS, Topographic Map, Giant Hill, Montana, 7 1/2 minute Quadrangle, 1986.



LABORATORY ANALYTICAL DATA

PARK  
PA NO. 04-012





**Park PA# 04-012**  
**AMRB HAZARDOUS MATERIALS INVENTORY**  
**INVESTIGATOR: PIONEER - BULLOCK**  
**INVESTIGATION DATE: 07/27/93**

**SOLID MATRIX ANALYSES**

**Results per dry weight basis**

**Metals in soils**

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
04-012-SE-1	4350 J	84.7	25	17.7 J	13 J	56.9 J	30600	0.144 J	1690 J	7 J	1850	9 UJ	2090 J	NR
04-012-SE-2	11 J	66	0.5 U	8.2 J	11 J	11.4 J	14500	0.064 J	399 J	8 J	11	6 UJ	46 J	NR
04-012-TP-1	1260 J	11 J	1	2.1 J	3 J	48.9 J	35500	0.056 J	143 J	3 UJ	4160	7 J	190 J	NR
04-012-WR-1	4730 J	59.9	14	7.9 J	6 J	159 J	65700	0.59 J	790 J	2 UJ	8270	19 J	1430 J	NR
04-012-WR-2	8900 J	50.4	18	6.6 J	7 J	202 J	58900	0.713 J	701 J	2 UJ	12800	27 J	2230 J	NR
04-012-WR-3	9820 J	30.1	101	16 J	86 J	308 J	71200	0.137 J	782 J	2 J	13100	33 J	2320 J	NR
BACKGROUND	44 J	315	1 U	24 J	15 J	28.9 J	37600	0.088 J	1220 J	9 J	31	11 UJ	112 J	NR

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Requested

**Acid/Base Accounting**

FIELD ID	TOTAL SULFUR		NEUTRAL SULFUR		ACID BASE SULFUR		PYRITIC SULFUR		ORGANIC SULFUR		PYRITIC SULFUR		ACID BASE POTENT.	
	%	U/10000	%	U/10000	%	U/10000	%	U/10000	%	U/10000	%	U/10000	%	U/10000
04-012-TP-1	2.00	62.5	-0.00	-0.00	1.97	-62.5	<0.01	0.03	0.03	0.00	0.00	-0.00		
04-012-WR-1	4.02	126	20.6	-105	0.37	-105	2.00	1.65	62.5	0.83	62.5	-41.8		
04-012-WR-2	1.25	39.0	-0.62	-39.7	0.82	-39.7	0.10	0.33	3.12	3.12	-3.74			
04-012-WR-3	0.20	6.25	2.58	-3.67	0.13	-3.67	0.02	0.05	0.62	0.62	1.96			

**WATER MATRIX ANALYSES**

**Results in ug/L**

**Metals in Water**

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
04-012-GW-1	548	2.01 U	44.7	9.7 U	6.83 U	64.2	3450	0.16	842 J	12.7 U	104	30.7 U	5710	81
04-012-GW-2	3380	7.6	563	134	6.83 U	975	32600	0.083	19900 J	36.8	252	93.7	73600	374
04-012-SW-1	71	15	11	9.7 U	6.83 U	15.6	902	0.055	324 J	12.7 U	19.4	30.7 U	1540	38.7
04-012-SW-2	169 U	30.3	25.7 U	9.7 U	6.83 U	7.43 J	308 J	0.093	14.5	13.2	1.55 U	30.7 U	46.1 J	21
04-012-SW-3	215	10.8	30.6	9.7 U	6.83 U	42.1 J	1700 J	0.11	495	12.7 U	31.2	30.7 U	3620 J	62.4

U - Not Detected, J - Estimated Quantity, X - Outlier for Accuracy or Precision, NR - Not Requested

**Wet Chemistry Results in mg/l**

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
04-012-GW-1	203	< 5.0	104	0.39	NR
04-012-GW-2	1270	< 5.0	800	0.31	<0.005
04-012-SW-1	121	< 5.0	30	0.08	<0.005
04-012-SW-2	105	< 5.0	5	< 0.05	NR
04-012-SW-3	167	< 5.0	76	0.19	NR

**LEGEND**

- SE1 - Downgradient Indian Creek.  
 SE2 - Seep below mill.  
 TP1 - Upgradient of subsamples TP1 and 2.  
 WR1 - Composite of subsamples WR1A, 1B, 2A, 3B, and 2C.  
 WR2 - Composite of subsamples WR3A, 4A, 4B, 4C, 5A, 6A, 6B, 7A, and 9A.  
 WR3 - Sample of the WR3 subsample.  
 BACKGROUND - From the Park Mine (04-012-SS-1).
- GW1 - Airt discharge at waste rock dump 2.  
 GW2 - Seep below mill.  
 SW1 - Same as sample SE1.  
 SW2 - Same as sample SE2.  
 SW3 - Eastern tributary prior to confluence.



XRF ANALYSIS RESULTS

PARK  
PA NO. 04-012



Mine Name: Park PA# 04-012  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
04-012-SS-1		12272.7	13532.3	2132.17		911.36 *	29945			99.9923 *		372.597
04-012-TP1-A		19597.5	11014.3	1543.93		269.322 *	23906.4			167.632	525.269	67.7599
04-012-TP2-A		32294.8	17199.5	3458.01		457.976 *	41409.7			154.309	939.688	228.069
04-012-TP-1-COMP		30649.7	16821.9	3024.32			38520.9			145.1	889.093	228.135
04-012-WR1-A		22753.1	2746.12	1820.45		2144.69	73846		201.413 *	1794.43	14344.5	140.878
04-012-WR1-B		15618.3	10472.9	1924.73		3413.59	58402		146.871 *	4179.61	2436.83	315.265
04-012-WR2-A		22125	17149.6	1574.25			81545.9			432.627	2027.6	99.9594
04-012-WR2-B		12122	49945.2	1871.46	190.648 *	2407.45	46205.2	333.798 *	47.9202 *	884.44	472.501	443.705
04-012-WR2-C	396.496 *	27791.1	7495.36	2490.83		865.238 *	86599.2		269.895	1389.49	7157.86	309.842
04-012-WR3-A		27427.1	3574.06	2305.84		598.1 *	66299.7		126.967 *	1034.01	1977.43	188.628
04-012-WR4-A		17579.5	3672.82	1109.84		484.617 *	88941.5	466.566 *	283.588	1806.2	9150.46	118.424
04-012-WR4-B	395.916 *	13481.2	9190.87	1026.1		3065.26	95468.6		458.082	2618.54	1589.6	185.981
04-012-WR4-C		12019.8	18546.3	1185.59		1511.56	110290		133.546 *	1382.73	20739.2	200.028
04-012-WR5-A		25491.6	5881.97	1807.31		11476.7	63895.4			140.101 *	149.733 *	50.6631
04-012-WR5-B		13722.6	20015.4	1251.45	189.574 *	331.84	26195.8	266.382 *		116.977 *		449.138
04-012-WR6-A		18489.5	2661.97	1477.46		1753.74	113110		176.386 *	1584.35	6116.42	136.449
04-012-WR6-B		22922.1	5227.54	1800.21			78948.4	508.412 *	98.7013 *	1172.53	6498.88	139.141
04-012-WR7-A		32165.6	5299.01	1935.99		32079.4		283.919 *		441.604	4488.98	34.0829
04-012-WR8-A		18176.9	2830.48	701.77		1863.52	95529.2		283.481	2148.75	9235.31	59.5965
04-012-WR9-A		21045.6	1822.94	2270.54			82441		87.1131 *	583.839	2477.94	164.087
04-012-WR-1-COMP		23341.6	20663.7	2234.85		2074.22	82984.6		134.981 *	2066.6	8112.63	299.8
04-012-WR-2-COMP		22621.6	6351.38	1776.83		1755.1	87728.6		190.136 *	1488.63	10409.4	115.881
Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th		
04-012-SS-1	169.424			80.5378			369.264			9.03132 *		
04-012-TP1-A	130.119		3065.3	154.137			436.986			16.0706 *		
04-012-TP2-A	128.022		1166.51	141.177			466.334			14.9316 *		
04-012-TP-1-COMP	138.064		2606.06	146.489			549.01					
04-012-WR1-A	136.332		8695.77	132.158			378.123					
04-012-WR1-B	127.732		2922.79	79.2637			484.899	111.441 *		15.1967 *		
04-012-WR2-A	103.108		3302.76	182.288			367.121	118.455 *		8.17064 *		
04-012-WR2-B	111.264		370.156	59.4743			597.245			16.0303 *		
04-012-WR2-C	143.234		8860.83	112.286	394.697 *		424.91					
04-012-WR3-A	147.573		7916.48	130.187			473.575					
04-012-WR4-A	115.059		14009.2	120.046			315.165	195.337 *		32.0843 *		
04-012-WR4-B	99.7741		19899.4	101.036			317.914	273.871 *		18.1229 *		
04-012-WR4-C	115.368		6828.96	101.036	326.84 *		333.359					
04-012-WR5-A	132.046		207.102	156.228			727.445					
04-012-WR5-B	144.527			74.1875		90.7024 *				11.5532 *		
04-012-WR6-A	113.214		7899.65	126.101			398.973	86.5693 *		14.8596 *		
04-012-WR6-B	144.584		8766.3	149.044			527.82	159.591 *				
04-012-WR7-A	193.755	50.4915		177.383		70.5244 *	424.073	234.144 *				
04-012-WR8-A	139.719		9716.48	130.574		83.947 *	336.862	178.961 *				
04-012-WR9-A	101.911		4318.15	174.152			365.763	148.823 *			32.1134 *	
04-012-WR-1-COMP	132.981		7325.37	127.477			453.461				18.7827 *	
04-012-WR-2-COMP	149.815	7.72015 *	10100	148.47			462.819	209.078 *				

\* - Estimated Quantity  
\$ - Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

PARK  
PA NO. 04-012



# **AIMSS SCORESHEET**

SITE NAME:

PARK

PA NUMBER:

04-012

LINE NO.			
<b>GROUNDWATER PATHWAY</b>			
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	20
3B		GW DEPTH	20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
6			900.113
7	GW - TARGETS	WELLS - 1 MI. x 2.5	0.0
8		WELLS - 1 TO 4 MI	16
9		NEAREST WELL	0
9		TARGETS SCORE	LINES 6 + 7 + 8
10			16.0
		<b>GROUNDWATER SCORE</b>	<b>LINES 4 x 5 x 9</b>
			5760723
<b>SURFACE WATER PATHWAY</b>			
11		OBSERVED RELEASE	300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES	100
13A		CONTAINMENT	20
13B		DISTANCE TO SW	20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
16			950.879
17	SW - TARGETS	DRINKING WATER POP'N	0
18		IMPACTED DRAINAGE	1
19		WETLANDS	10
20		FISHERY	1
21		RECREATION	5
22		IRRIGATION/STOCK	2
23		T & E SPECIES HABITAT	5
23		TARGETS SCORE	SUM LINES 16 - 22
24			24
		<b>SURFACE WATER SCORE</b>	<b>LINES 14 x 15 x 23</b>
			18256877
<b>AIR PATHWAY</b>			
25		OBSERVED RELEASE	0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT	10
26B		DISTANCE TO POPULATION	10
26C		POTENTIAL TO RELEASE	LINES 26A x 26B
27		LIKELIHOOD SCORE	LINES 25 + 26C
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
29			3.980
30	AIR - TARGETS	POPULATION - 4 MILES	10
31		NEAREST RESIDENCE	5
32		WETLANDS	10
33		PARKS / WILDERNESS	0
34		T & E SPECIES HABITAT	5
34		TARGETS SCORE	SUM LINES 29 - 33
35			30
		<b>AIR PATHWAY SCORE</b>	<b>LINES 27 x 28 x 34</b>
			11940
<b>DIRECT CONTACT PATHWAY</b>			
36		OBSERVED EXPOSURE	50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY	20
37B		DISTANCE TO POPULATION	10
37C		POTENTIAL EXPOSURE	LINES 37A x 37B
38		LIKELIHOOD SCORE	LINES 36 + 37C
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
40			3.745
41	DIRECT CONTACT TARGETS	POPULATION - 1 MILE	1
42		NEAREST RESIDENCE	5
43		RECREATIONAL USE	5
43		TARGETS SCORE	SUM LINES 40 - 42
44			11
		<b>DIRECT CONTACT SCORE</b>	<b>LINES 38 x 39 x 43</b>
			10299
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>		
	(LINES 10 + 24 + 35 + 44) / 100,000		
			240.40

LINE NO.			SITE NAME:	PARK
			PA NUMBER:	04-012
1	<b>SITE SAFETY</b>			
2	THREAT	ACCESSIBILITY		20
3		OPEN SHAFTS	100 EA.	100
4	HAZARDS	OPEN ADITS	50 EA.	100
5		UNSTAB. HIWALLS / PITS	75 EA.	0
6		HAZ. STRUCTURES	40 EA.	640
7		EXPLOSIVES		0
8		HAZ. MATERIALS		0
9		HAZARDS SCORE	SUM LINES 2 - 7	840
10	TARGETS	POPULATION - 1 MILE		1
11		NEAREST RESIDENCE		5
12		RECREATIONAL USE		5
13		TARGETS SCORE	SUM LINES 9 - 11	11
		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>184.80</b>

**SUMMARY OF HISTORICAL ANALYTICAL DATA  
FROM OTHER SOURCES**

Dick J.

STATE HEALTH DEPT.

WATER QUALITY BUREAU

HELENA, MONTANA 59601

STATE	MONTANA	COUNTY	BROADWATER
LAT.-LONG.	4622 2N 1114218W	SAMPLE LOCATION	7N 1W 15AA
STATION CODE		ANALYSIS NUMBER	81W2025
DATE SAMPLED	10-05-81	DRAINAGE BASIN	411
TIME SAMPLED	1500	WATER FLOW RATE	5.00GPM(E)
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE		ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	DSL	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: PARK MINE ADIT DISCHARGE TO INDIAN CREEK

CALCIUM (CA)	MG/L	MEQ/L	BICARBONATE (HCO3)	MG/L	MEQ/L
MAGNESIUM (MG)			CARBONATE (CO3)		
SODIUM (NA)			CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)		
			FLUORIDE (F)		
			PHOSPHATE (PO4 AS P)		
			NO3+NO2 (TOT AS N)		

**RECEIVED**  
DEC 29 1981  
STATE LANDS

SUM CATIONS	0.0	0.0	SUM ANIONS	0.0	0.000
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LABORATORY PH	TOT HARDNESS (MG/L-CACO3)
FIELD WATER TEMPERATURE (C)	TOT ALKALINITY (MG/L-CACO3)
SUM-DISS. IONS MEAS. (MG/L)	LABORATORY TURBIDITY (NTU)
LAB CONDUCTIVITY-UMHOS-25C	SODIUM ADSORPTION RATIO

A D D I T I O N A L P A R A M E T E R S

COPPER, TR (MG/L AS CU)	.03	LEAD, TR (MG/L AS PB)	< .05
ZINC, TR (MG/L AS ZN)	5.8	IRON, TR (MG/L AS FE)	.68

REMARKS: AML PROGRAM DSL

BILL TO AML, STATE LANDS

NO BOTTLE FOR COMMONS

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER  
 ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED  
 (M)= MEASURED(R)=REPORTED (E)=ESTIMATED M=METERS TR=TOTAL RECOVERABLE

SAMPLE NO B	SAMPLER LHP	HANDLING 11	ANALYST JH	LAB
COMPLETED 10-28-81	COMPUTER RUN	12/21/81	DATA 0975/PROG	0876 FUND
TND DEV. ION BALANCE	0.00	CA	MG	NA
SEGMENT	MPDES	0.0	0.0	0.0
CALC. MEQ/L= INSUFFICIENT DATA		0.0	0.0	0.0

81W2025



STATE HEALTH DEPT.

WATER QUALITY BUREAU

HELENA, MONTANA 59601

STATE	MONTANA	COUNTY	BROADWATER
LAT.-LONG.	4622 2N 1114218W	SAMPLE LOCATION	7N 1W 15AA
SECTION CODE		ANALYSIS NUMBER	81W2026
DATE SAMPLED	10-05-81	DRAINAGE BASIN	411
TIME SAMPLED	1500	WATER FLOW RATE	3.00CFS(E)
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE		ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	DSL	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: PARK MINE -BELOW DISCHARGE-INDIAN CREEK

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)			BICARBONATE(HCO3)		
MAGNESIUM (MG)			CARBONATE (CO3)		
SODIUM (NA)			CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)		
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)		
			NO3+NO2 (TOT AS N)		

SUM CATIONS	0.0	0.0	SUM ANIONS	0.0	0.000
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LABORATORY PH  
FIELD WATER TEMPERATURE (C)  
DISS. IONS MEAS.(MG/L)  
CONDUCTIVITY-UMHOS-25C

TOT HARDNESS(MG/L-CAC03)  
TOT ALKALINITY(MG/L-CAC03)  
LABORATORY TURBIDITY (NTU)  
SODIUM ADSORPTION RATIO

A D D I T I O N A L P A R A M E T E R S					
COPPER,TR (MG/L AS CU)	< .01	LEAD,TR (MG/L AS PB)	< .05		
ZINC,TR (MG/L AS ZN)	.91	IRON,TR (MG/L AS FE)	.08		

REMARKS: AML PROGRAM DSL

BILL TO AML, STATE LANDS

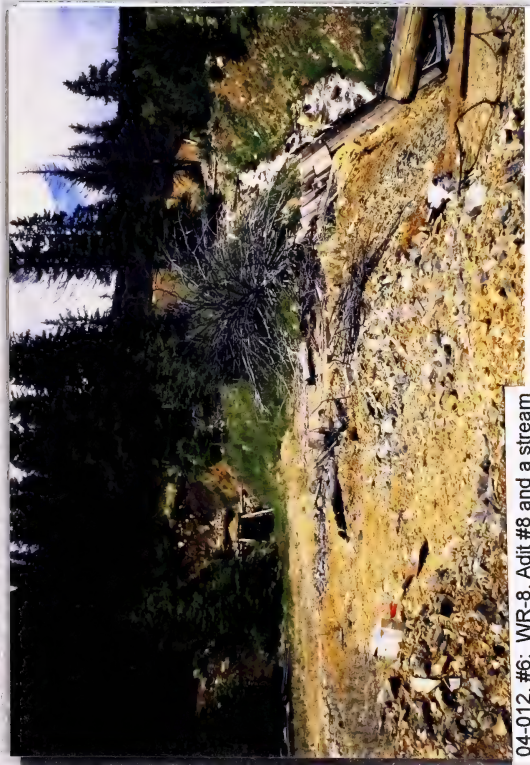
NO BOTTLE FOR COMMONS

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVILENTS PER LITER  
ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED  
(M)= MEASURED(R)=REPORTED (E)=ESTIMATED M=METERS TR=TOTAL RECOVERABLE

SAMPLE NO A	SAMPLER LHP	HANDLING 11	ANALYST JA	LAB
COMPLETED 10-28-81	COMPUTER RUN 12/03/81	DATA 0975/PROG 0876	FUND	
DEV. ION BALANCE 0.00	CA	MG	NA	K
SEGMENT MPDES	0.0	0.0	0.0	0.0
CALC. MEQ/L= INSUFFICIENT DATA	33.3	33.3	0.0	33.3
	0.0	0.0	0.0	0.0

81W2026





04-012, #6: WR-8, Adit #8 and a stream



04-012, #7: Remains of possible second old mill



04-012, #8: Shaft at WR-1

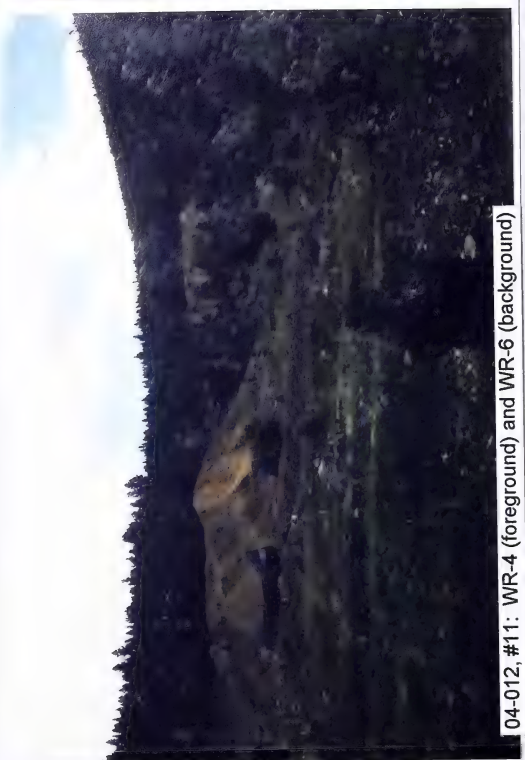


04-012, #9: WR-1





04-012, #10: WR-2 and loadout; mill



04-012, #11: WR-4 (foreground) and WR-6 (background)



04-012, #12: Adit associated with WR-2; GW-1 sample location



04-012, #13: Adit #9





04-012, #15: Adit #4 (HMO)



04-C12, #16: SW-3 sample location



04-012, #14: WR-9





MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: ST. LOUIS PA#: 04-013

Date: July 27, 1993 Time: \_\_\_\_\_

Field Team Leader: Bullock, Pioneer

Sampling Personnel: Clark, Pioneer  
Pierson, TD&H

Visitors: None

Weather/Seasonality Observations: Warm; clear; calm; cool, wet  
spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #17: SW-1 sample  
location; #18: Runoff path from leaching area; #19: SW-2 sample  
location; #20: Leaching facility; #21: Pregnant pond; #22: Open  
cut. Video Tape No. 4

General Comments/Observations (not covered specifically in attached Inventory Forms): Borings with a power auger may be necessary to determine  
contaminant presence and release.

Other Hazardous Materials/Substances Present: Hoppers or mixing  
tanks with reagent residues remain on the site.

General Comments on Potential Remedial Alternatives: Further study  
is necessary; release of metals in stream and elevated cyanide in  
the leach pad material.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): ST. LOUIS PA#: 04-013

Legal Description: T 7N ; R 1W ; Sec. 26 , NW1/4 NW1/4 1/4

County: BROADWATER Mining District: INDIAN CREEK

Latitude: N 46° 20' 19" Longitude: W 111° 41' 55"

Primary Drainage Basin and Code: Indian Creek/10030101

Secondary Drainage Basin: West Fork Indian Creek

USGS Quadrangle map name(s): Giant Hill

Mine Type/Commodities: Hardrock/Gold, Silver, Lead

Activity Status: Active      , Inactive/Exploration      , Abandoned X .

Ownership status: Known YX N ; private/public? Private/Public  
Owner, Agent, or Contact (Include address and phone when available): Edward E. Linder, c/o John F. McIntyre, 211-9250 120th Street, Surrey, British Columbia, Canada V3V 4B7; Celina Carter and Ellen Grogan, 3428 Ashley Terrace NW, Washington D.C. 20008; Helena National Forest.

Relationship to other mines/sites in the area/district: Deposit similar to that of Marietta Mine. Numerous mines and prospects in the area.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 6600' , Slope 10°-20° ,  
Aspect South

Land use: Mining      , Recreational X , Residential X , Urban      ,  
Agricultural X , Other (Specify)     

Area of disturbed/unvegetated lands? Approx. 1 acres.

Dimensions: Approx. 510 feet x 110 feet

Predominant vegetation types: Douglas fir, juniper, sage, willows, grasses

Access: roads - good X , poor      , 4wd      , trail      .

Other logistical considerations (proximity to other sites). Locked gate; open route down from Park/Marietta mine.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach MBMG Well Log Printout(s): There are 3 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Site lies on ridge between two unnamed tributaries of the West Fork of Indian Creek. Water leaving the site would flow south approx. 1 mile to confluence with West Fork Indian Creek. Site is underlain by Elkhorn Mountain Volcanics. Indian Creek fault extends up valley of West Fork Indian Creek.

Mining/milling history, ore type/tenor, host rock, gangue: Shaft was inaccessible since 1960. Minerals in dump associated with vein mineralization were pyrite, galena arsenopyrite, sphalerite with a quartz gangue. Production from shaft was listed at less than 500 tons.

#### Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes     , No X, #     , Comment       
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes X, No     , # 1, Comment Open cut

Mill Operation? Yes X, No     . If yes answer the next three questions:

Period(s) of Operation: Recent

Origin of Ore Milled - Custom Mill      Dedicated Mill X; Number and names of mines that supplied mill feed: Small operation-appears to have been dedicated.

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
CN- heap leach

Montana Bureau of Mines and Geology  
Water Well Log Data

11/05/1993

Well No.	Location	Depth	Yield	Static Water Level
M:55739	07N 01W 36 B	33.0	0.0	11.00
M:55740	07N 01W 36 C	62.0	0.0	43.00
M:55741	07N 01W 36 D	35.0	0.0	27.00

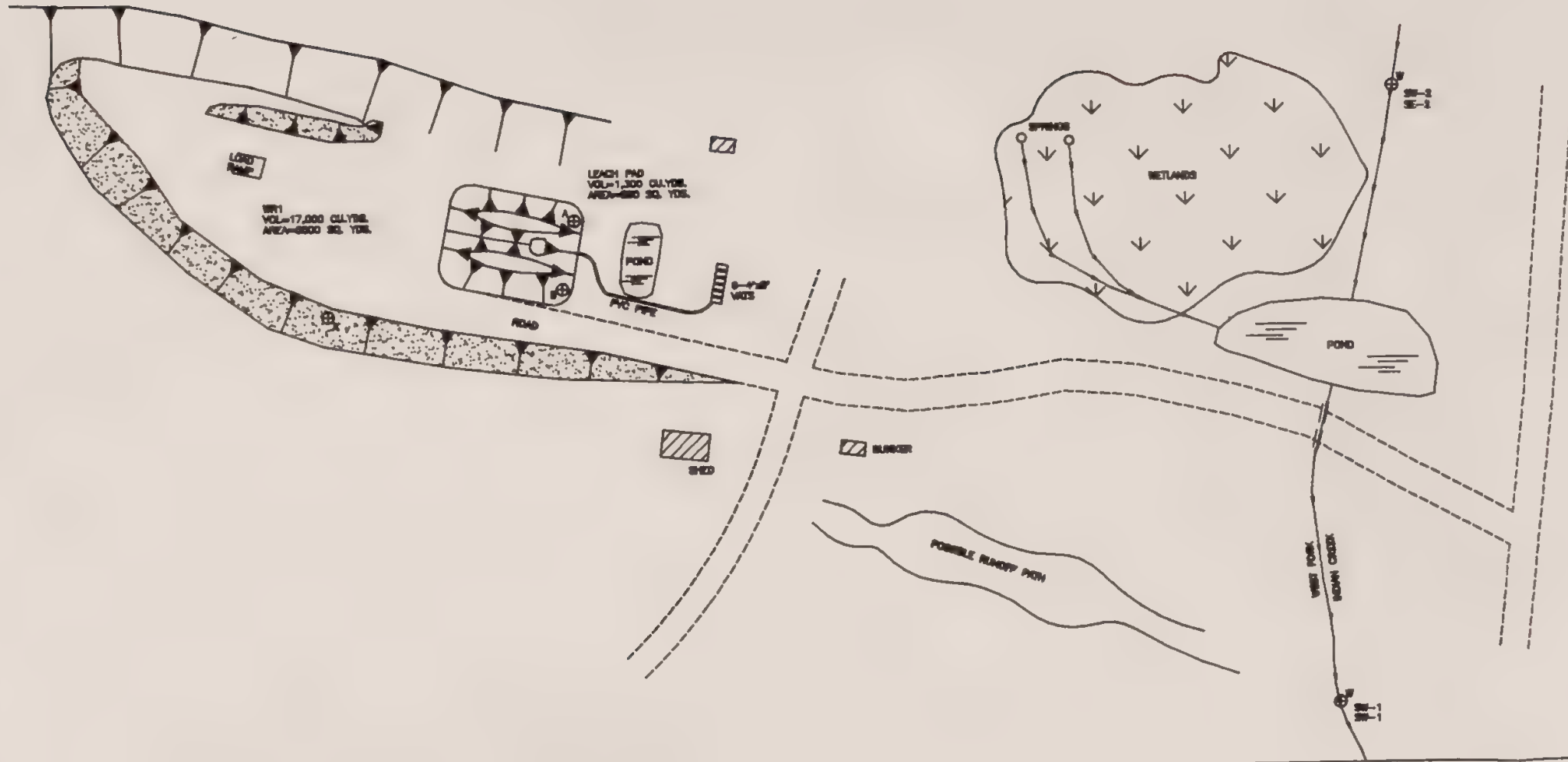






SCALE: 1" = 1000'





SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
=====	CULVERT	---X---	OPEN AFT
*--*	LIGHT (LIGHT POLE)	---X---	COLLAPSED AFT
●	UTILITY POLE	---X---	OPEN SHAFT
●	DECIDUOUS TREE	---X---	COLLAPSED SHAFT
●	CONIFEROUS TREE	---X---	DECAYATION
---	WOOD FENCE	---X---	WASTE ROCK DUMP
---	WIRE FENCE	---X---	COLLAPSED TIMBERS
---	BUILDING	---	RAILS
---	BARRIER POST	---	SOIL SAMPLE
>	GATE	---	10' SAMPLE
---	EDGE OF ASPHALT	---	WATER SAMPLE
---	EDGE OF GRAVEL	---	GROUND AND SURFACE
---	SLOPE DIRECTION	---	DRAINAGE
---	TAILINGS POND	---	WATER WELL
		---	PONDED WATER
		---	VEGETATED WET LANDS

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY  
ST. LOUIS PA# 04-013  
INDIAN CREEK BROADWATER COUNTY

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON

DRAWN: INC. DATE: 2 DEC 93  
 DESIGNED: TPR JOB NO: 93-17  
 APPROVED: MUR F.B. NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
Leach pad material is coarse rocks. \_\_\_\_\_

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): No stratification; depth is 8 feet.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Material on pad is moist near the bottom.

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Liner present is ripped and torn where exposed.

Comments on potential for mitigation: Grade, amend or cover, and revegetate.





# SOURCE INVENTORY FORM

**SAMPLERS:** Bullock, Pierson, Clark

[illegible]

Diluent reading (Galvanometer) : 0-Saturated Potate (Orion Meter)

Comments or deviations from SOPs: 04-013-LP-1 is a composite of LP-1A and 1B. 04-013-WR-1 is a composite of WR-1.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes     , No X, Number:      Identification:     

Filled shafts: Yes     , No X, Number:      Identification:     

Seeps/Springs: Yes X, No     , Number: 2 Identification: Upgradient in West Fork drainage

Groundwater wells within 4 miles?: Yes X, No     ;  
Number of well logs: 16

Distance to nearest well used for drinking? 0.75 mile

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite     , Probable X, Possible     , Unlikely     .

Liner is presently in poor condition; elevated levels of metals in surface water indicate groundwater contamination.

Other observations/notes: N/A

## SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No   , Name(s): West Fork of Indian Creek

Dry streambeds: Yes   , No X, Name(s):   

Other surface water: Yes X, No   , Name(s)/Description: Small barren pond

Waste materials within any floodplain: Yes   , No X Source ID(s):   

Approximate Flood frequency?    1 yr,    10 yr,    100 yr

Estimated seasonal flow of stream(s) (cfs)? N/A

High Flow:   , Average Flow:   

Distance between waste source(s) and nearest surface water body (ft)? Approximately 400 feet

Surface water draining onto or through waste sources: Yes   , No X, Describe:   

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Agriculture, irrigation, fishery, T&E-Bald Eagle

Observed erosional/sedimentation/stream turbidity problems? Yes   , No X, Distance downstream (ft)?    Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):  
There is a small mine in drainage approx. 500' downstream from SW-1 that may impact the drainage.



**SAMPLERS:** Bullock

**FLOW: Estimated (E) or Measured (M)?**

 Comments or Deviations from the SOPs (Pioneer SAP, 1993): | NM = Not Measured |

#### D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

##### AMD Characteristics:

Presence and abundance of sulfides? (SO<sub>3</sub>)  
Presence of evaporative salt deposits? (ESD)  
Discolored or turbid seepage? (SPG)  
Presence of long filamentous algae in drainages, mosses in moist areas?  
Presence of ferric hydroxide precipitates? (FEOX)  
Presence of burned or stressed vegetation? (VEG)  
pH ≤ 5.0 (pH)

##### General Potential for AMD Mitigation:

Area available for treatment (acres)? 20 acres (moderately steep)

Wetlands present: Yes X, No   , Describe: Small wetlands in seep area.

Carbonate rocks/soils: Yes   , No X, Describe: None observed

#### E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10 X; 10-30   ; 30-100   ;  
100-300   ; 300-1,000   ; 1,000-3,000   ; 3,000-10,000   ; 10,000 or  
greater   ; Comments   

Nearest residence(ft or miles)? 0.25 mile (recreational)

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:  
observed high moderate low none



**SAMPLERS:** Bullock, Pierson, Clark

[illegible]

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X, Describe:\_\_\_\_\_

Population within 1 mile: 1-10 X; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_; 300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_; Comments\_\_\_\_\_

Evidence of recreational use on site: Yes\_\_\_\_, No X, Describe:\_\_\_\_\_  
Recreational use of the area is evident.\_\_\_\_\_

Accessibility - Fences, warning signs, closed roads? Locked gate by one route; other routes are open.\_\_\_\_\_

Sensitive environments on-site or adjacent to site:

State or National Parks - Yes\_\_\_\_, No X, Comment\_\_\_\_\_  
Wilderness Area - Yes\_\_\_\_, No X, Comment\_\_\_\_\_  
T&E Species Habitat - Yes\_\_\_\_, No X, Comment\_\_\_\_\_  
Bat Habitat - Yes\_\_\_\_, No X, Comment\_\_\_\_\_

Primary Drainage X; Secondary Drainage\_\_\_\_; No Information\_\_\_\_:

Riparian Habitat Quality - High\_\_\_\_, Medium X, Low\_\_\_\_  
Wetlands Frontage - High\_\_\_\_, Medium X, Low\_\_\_\_  
Fisheries Habitat and Species Classification - 4  
Sport Fishery Classification - 5

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_\_

Hazardous structures: Yes X, No\_\_\_\_, Number 3, types and locations:\_\_\_\_\_  
There are two sheds and one bunker.\_\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes X, No\_\_\_\_, Number 1, types and locations: Trench highwall is approximately 20 to 40 feet high.\_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_\_

Fire and/or Explosion hazards: Yes X, No\_\_\_\_, Explain: Structures\_\_\_\_\_

## Bibliography

- MBMG, Mines and Mineral Deposits (Except Fuels), Broadwater County, Montana, Information Circular 7592, Written by Glenn C. Reed, April 1951.
- MBMG, Ore Deposits of the Northern Part of the Park (Indian Creek) District, Broadwater County, Montana, Bulletin 35, Written by Elmer M. Schell, June 1963.
- MBMG, St. Louis Mine, Broadwater County, Form 39, 1975-1984.
- MBMG, Well Log Database, September 8, 1993.
- MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.
- MDHES, Sampling Analysis Report for Indian Creek, Prepared by U.S. Forest Service, Townsend Office, June 14, 1993.
- MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for St. Louis, Prepared by Northern Engineering and Testing, May 19, 1988.
- USGS, Topographic Map, Giant Hill, Montana, 7 1/2 minute Quadrangle, 1986.



LABORATORY ANALYTICAL DATA

ST. LOUIS  
PA NO. 04-013





St. Louis PA# 04-013  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - Bullock  
INVESTIGATION DATE: 07/27/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/Kg)	Ba (mg/Kg)	Cd (mg/Kg)	Co (mg/Kg)	Cr (mg/Kg)	Cu (mg/Kg)	Fe (mg/Kg)	Hg (mg/Kg)	Mn (mg/Kg)	Ni (mg/Kg)	Pb (mg/Kg)	Sb (mg/Kg)	Zn (mg/Kg)	CYANIDE (mg/Kg)
04-013-LP-1	2110 J	47.6	9	7.9 J	5 J	202 J	33900	0.184 J	307 J	5 J	1110	7 J	1180 J	5.27
04-013-SE-1	22	78.4	2.6	7.1	7	19.1	22100	0.035 J	277	3 J	318	6 UJ	368	NR
04-013-SE-2	11	34.2	0.9	11	5.9	7.2	18600	0.017 J	335	5 J	15	6 UJ	60	NR
04-013-WR-1	4840 J	81.6	38	9 J	4 J	316 J	37500	0.164 J	776 J	4 J	2590	7 J	1540 J	NR
BACKGROUND	44 J	315	1 U	24 J	15 J	28.9 J	37600	0.088 J	1220 J	9 J	31	11 UJ	112 J	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL		SULFUR		SULFATE		PYRITIC		ORGANIC		PYRITIC		SULFUR	
	TOTAL SULFUR %	ACID BASE %	NEUTRAL. POTENT. %	ACID BASE %	POTENT. %	SULFUR %	PYRITIC SULFUR %	ACID BASE %	SULFUR %	POTENT. %	ACID BASE %	PYRITIC SULFUR %	ACID BASE %	POTENT. %
04-013-LP-1	0.74	23.1	13.6	-9.52	<0.01	0.25	0.56	7.81	5.78					
04-013-WR-1	0.35	10.9	8.29	-2.64	0.33	<0.01	0.03	0.00	8.29					

WATER MATRIX ANALYSES

Metals in Water  
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO3/L)
04-013-SW-1	3	< 16.6 U	2.57 U	9.7 U	6.83 U	1.55 U	666	0.044	18.3 J	12.7 U	13.1	30.7 U	20.7 U	74.7
04-013-SW-2	0.96 U	7.67	2.57 U	9.7 U	6.83 U	1.55 U	44.5	0.052	9.1 J	12.7 U	1.86	30.7 U	7.57 U	71.3

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry  
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
04-013-SW-1	150	< 5.0	13	0.13	< 0.00
04-013-SW-2	151	< 5.0	10	0.47	NR

LEGEND

LP1 - Composite LPIA and 1B (Leach Pad).  
SE1 - Downgradient on West Fork Indian Creek.  
SE2 - Upgradient on West Fork Indian Creek.  
WR1 - Sample of the WR1 subsample.  
BACKGROUND - From the Park Mine (04-012-SS-1).  
SW1 - Same as sample SE1.  
SW2 - Same as sample SE2.



**XRF ANALYSIS RESULTS**

**ST. LOUIS  
PA NO. 04-013**



Mine Name: St. Louis PA# 04-013  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
04-013-LP1-A		44787.6	5870.83	1776.84		777.095 *	38055.5	344.743 *	210.055	354.21	690.194	371.576
04-013-LP1-B		33293.2	22265.6	3118.9		411.641 *	59499.4		268.463	1862.07	5175.84	260.848
04-013-LP-1-COMP		38382.3	11599.6	1885.78		714.173 *	44554.3		304.12	807.629	1964.3	345.238
04-013-WR-1	329.909 *	26014	5821.57	2071.09		579.287 *	58468.4	368.3 *	274.479	1602.76	5107.4	189.654
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
04-013-LP1-A	114.773			382.339	224.645			1202.13			9.45868 *	
04-013-LP1-B	138.746			3362	124.73	259.502 *		375.475			15.4494 *	
04-013-LP-1-COMP	129.392			1203.25	184.034		75.7414 *	1048.58		12.0283 *	10.2557 *	
04-013-WR-1	132.259			2889.84	111.72			346.278			11.2794 *	

\* - Estimated Quantity  
\$ - Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

ST. LOUIS  
PA NO. 04-013



# **AIMSS SCORESHEET**

**SITE NAME:**  
**PA NUMBER:**

**ST. LOUIS**  
**04-013**

LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		10
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	200
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	200
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	77.089
6		WELLS - 1 MI. x 2.5		7.5
7	GW - TARGETS	WELLS - 1 TO 4 MI		13
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	20.5
10		<b>GROUNDWATER SCORE</b>	<b>LINES 4 x 5 x 9</b>	<b>316065</b>
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		0
13A		CONTAINMENT		20
13B		DISTANCE TO SW		2
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	40
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	340
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	79.891
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		0
19	SW - TARGETS	FISHERY		1
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	8
24		<b>SURFACE WATER SCORE</b>	<b>LINES 14 x 15 x 23</b>	<b>217304</b>
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		1
26B		DISTANCE TO POPULATION		10
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	10
27		LIKELIHOOD SCORE	LINES 25 + 26C	10
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.799
29		POPULATION - 4 MILES		1
30		NEAREST RESIDENCE		5
31	AIR - TARGETS	WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	16
35		<b>AIR PATHWAY SCORE</b>	<b>LINES 27 x 28 x 34</b>	<b>128</b>
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		0
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		5
37B		DISTANCE TO POPULATION		10
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	50
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.771
40	DIRECT CONTACT	POPULATION - 1 MILE		1
41	TARGETS	NEAREST RESIDENCE		5
42		RECREATIONAL USE		0
43		TARGETS SCORE	SUM LINES 40 - 42	6
44		<b>DIRECT CONTACT SCORE</b>	<b>LINES 38 x 39 x 43</b>	<b>231</b>
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			
	(LINES 10 + 24 + 35 + 44) / 100,000			<b>5.34</b>

LINE NO.			SITE NAME:	ST. LOUIS
			PA NUMBER:	04-013
		<b>SITE SAFETY</b>		
1	THREAT	ACCESSIBILITY		5
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	75
5		HAZ. STRUCTURES	40 EA.	120
6		EXPLOSIVES		0
7		HAZ. MATERIALS		100
8		HAZARDS SCORE	SUM LINES 2 - 7	295
9	TARGETS	POPULATION - 1 MILE		1
10		NEAREST RESIDENCE		5
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 - 11	6
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>8.85</b>

**SUMMARY OF HISTORICAL ANALYTICAL DATA  
FROM OTHER SOURCES**

June 14, 1993

testname	sampleid	date	reported	units
C9305-101623 FLUORIDE IN WATER	HELLGATE	05/20/93	0.12	MG/L
C9305-101623 IRON	HELLGATE	05/20/93	0.33	MG/L
C9305-101623 HARDNESS GRAINS PER GALLON	HELLGATE	05/20/93	17.2	G/PG
C9305-101623 TOTAL HARDNESS AS CaCO3	HELLGATE	05/20/93	294.9	MG/L
C9305-101623 BICARBONATE	HELLGATE	05/20/93	256	MG/L
C9305-101623 POTASSIUM	HELLGATE	05/20/93	0.6	MG/L
C9305-101623 MAGNESIUM	HELLGATE	05/20/93	42.1	MG/L
C9305-101623 MANGANESE	HELLGATE	05/20/93	0.023	MG/L
C9305-101623 SODIUM	HELLGATE	05/20/93	1.5	MG/L
C9305-101623 NITRATE PLUS NITRITE AS N	HELLGATE	05/20/93	0.14	MG/L
C9305-101623 ORTHO-PHOSPHORUS	HELLGATE	05/20/93	0.018	MG/L
C9305-101623 LEAD	HELLGATE	05/20/93	0.001	MG/L
C9305-101623 PH IN WATER	HELLGATE	05/20/93	8.41	UNITS
C9305-101623 SILICA IN WATER BY ICP	HELLGATE	05/20/93	9.7	MG/L
C9305-101623 SULFATE IN WATER	HELLGATE	05/20/93	46.5	MG/L
C9305-101623 SPECIFIC CONDUCTANCE	HELLGATE	05/20/93	514	UMHOS
C9305-101623 ZINC	HELLGATE	05/20/93	< 0.005	MG/L
C9305-101624 ALKALINITY IN WATER	INDIAN CR LOWER	05/21/93	28	MG/L
C9305-101624 ARSENIC	INDIAN CR LOWER	05/21/93	0.07	MG/L
C9305-101624 CALCIUM	INDIAN CR LOWER	05/21/93	20.8	MG/L
C9305-101624 CADMIUM	INDIAN CR LOWER	05/21/93	0.004	MG/L
C9305-101624 CHLORIDE IN WATER	INDIAN CR LOWER	05/21/93	< 1.0	MG
C9305-101624 COPPER	INDIAN CR LOWER	05/21/93	< 0.01	MG
C9305-101624 FLUORIDE IN WATER	INDIAN CR LOWER	05/21/93	< 0.10	MG/L
C9305-101624 IRON	INDIAN CR LOWER	05/21/93	0.46	MG/L
C9305-101624 HARDNESS GRAINS PER GALLON	INDIAN CR LOWER	05/21/93	3.7	G/PG
C9305-101624 TOTAL HARDNESS AS CaCO3	INDIAN CR LOWER	05/21/93	64.7	MG/L
C9305-101624 BICARBONATE	INDIAN CR LOWER	05/21/93	33	MG/L
C9305-101624 POTASSIUM	INDIAN CR LOWER	05/21/93	0.4	MG/L
C9305-101624 MAGNESIUM	INDIAN CR LOWER	05/21/93	3.1	MG/L
C9305-101624 MANGANESE	INDIAN CR LOWER	05/21/93	0.056	MG/L
C9305-101624 SODIUM	INDIAN CR LOWER	05/21/93	2.3	MG/L
C9305-101624 NITRATE PLUS NITRITE AS N	INDIAN CR LOWER	05/21/93	0.02	MG/L
C9305-101624 ORTHO-PHOSPHORUS	INDIAN CR LOWER	05/21/93	0.025	MG/L
C9305-101624 LEAD	INDIAN CR LOWER	05/21/93	0.01	MG/L
C9305-101624 PH IN WATER	INDIAN CR LOWER	05/21/93	7.65	UNITS
C9305-101624 SILICA IN WATER BY ICP	INDIAN CR LOWER	05/21/93	14.7	MG/L
C9305-101624 SULFATE IN WATER	INDIAN CR LOWER	05/21/93	24.6	MG/L
C9305-101624 SPECIFIC CONDUCTANCE	INDIAN CR LOWER	05/21/93	127	UMHOS
C9305-101624 ZINC	INDIAN CR LOWER	05/21/93	0.51	MG/L
C9305-101625 ALKALINITY IN WATER	INDIAN CR UPPER		14.4	MG/L
C9305-101625 ARSENIC	INDIAN CR UPPER		0.085	MG/L
C9305-101625 CALCIUM	INDIAN CR UPPER		16.9	MG/L
C9305-101625 CADMIUM	INDIAN CR UPPER		0.008	MG/L
C9305-101625 CHLORIDE IN WATER	INDIAN CR UPPER		< 1.0	MG/L
C9305-101625 COPPER	INDIAN CR UPPER		< 0.01	MG/L
C9305-101625 FLUORIDE IN WATER	INDIAN CR UPPER		< 0.10	MG/L
C9305-101625 IRON	INDIAN CR UPPER		0.6	M
C9305-101625 HARDNESS GRAINS PER GALLON	INDIAN CR UPPER		3.0	G/PG

APPROVED BY: DLB

\*\*\*FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-2642



June 14, 1993

testname	sampleid	date	reported	units
C9305-101625 TOTAL HARDNESS AS CaCO3	INDIAN CR UPPER		51.7	MG/L
C9305-101625 BICARBONATE	INDIAN CR UPPER		17	MG/L
C9305-101625 POTASSIUM	INDIAN CR UPPER		0.5	MG/L
C9305-101625 MAGNESIUM	INDIAN CR UPPER		2.3	MG/L
C9305-101625 MANGANESE	INDIAN CR UPPER		0.115	MG/L
C9305-101625 SODIUM	INDIAN CR UPPER		2.1	MG/L
C9305-101625 NITRATE PLUS NITRITE AS N	INDIAN CR UPPER		0.05	MG/L
C9305-101625 ORTHO-PHOSPHORUS	INDIAN CR UPPER		0.031	MG/L
C9305-101625 LEAD	INDIAN CR UPPER		0.016	MG/L
C9305-101625 PH IN WATER	INDIAN CR UPPER		7.4	UNITS
C9305-101625 SILICA IN WATER BY ICP	INDIAN CR UPPER		14.3	MG/L
C9305-101625 SULFATE IN WATER	INDIAN CR UPPER		26.1	MG/L
C9305-101625 SPECIFIC CONDUCTANCE	INDIAN CR UPPER		100	UMHOS
C9305-101625 ZINC	INDIAN CR UPPER		0.822	MG/L
C9305-101626 ALKALINITY IN WATER	WEASEL CR. UPPER		31.6	MG/L
C9305-101626 ARSENIC	WEASEL CR. UPPER		0.034	MG/L
C9305-101626 CALCIUM	WEASEL CR. UPPER		23	MG/L
C9305-101626 CADMIUM	WEASEL CR. UPPER		0.002	MG/L
C9305-101626 CHLORIDE IN WATER	WEASEL CR. UPPER		1.1	MG/L
C9305-101626 COPPER	WEASEL CR. UPPER		< 0.01	MG/L
C9305-101626 FLUORIDE IN WATER	WEASEL CR. UPPER		< 0.10	MG/L
C9305-101626 IRON	WEASEL CR. UPPER		1.24	MG/L
C9305-101626 HARDNESS GRAINS PER GALLON	WEASEL CR. UPPER		4.1	G/PG
C9305-101626 TOTAL HARDNESS AS CaCO3	WEASEL CR. UPPER		70.6	MG/L
C9305-101626 POTASSIUM	WEASEL CR. UPPER		1.5	MG/L
C9305-101626 MAGNESIUM	WEASEL CR. UPPER		3.2	MG/L
C9305-101626 MANGANESE	WEASEL CR. UPPER		0.142	MG/L
C9305-101626 SODIUM	WEASEL CR. UPPER		3.8	MG/L
C9305-101626 NITRATE PLUS NITRITE AS N	WEASEL CR. UPPER		0.94	MG/L
C9305-101626 ORTHO-PHOSPHORUS	WEASEL CR. UPPER		0.079	MG/L
C9305-101626 LEAD	WEASEL CR. UPPER		0.034	MG/L
C9305-101626 PH IN WATER	WEASEL CR. UPPER		7.68	UNITS
C9305-101626 SILICA IN WATER BY ICP	WEASEL CR. UPPER		21.9	MG/L
C9305-101626 SULFATE IN WATER	WEASEL CR. UPPER		35	MG/L
C9305-101626 SPECIFIC CONDUCTANCE	WEASEL CR. UPPER		166	UMHOS
C9305-101626 ZINC	WEASEL CR. UPPER		0.345	MG/L

F

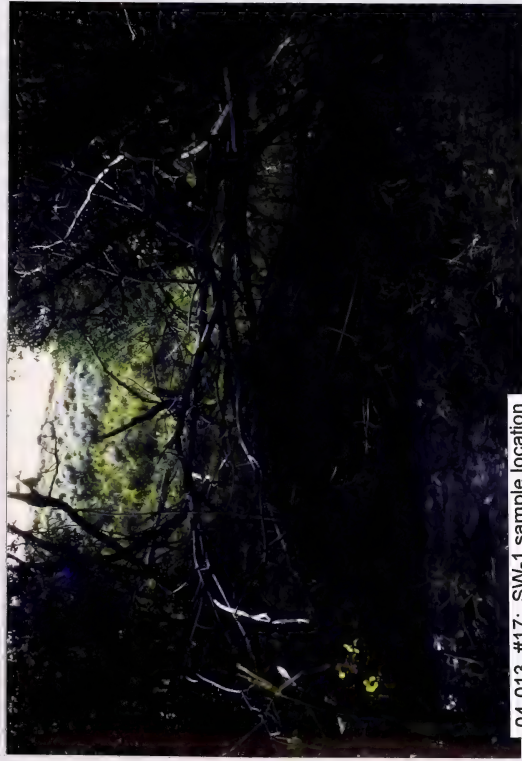
APPROVED BY: DLB

\*\*FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-2642

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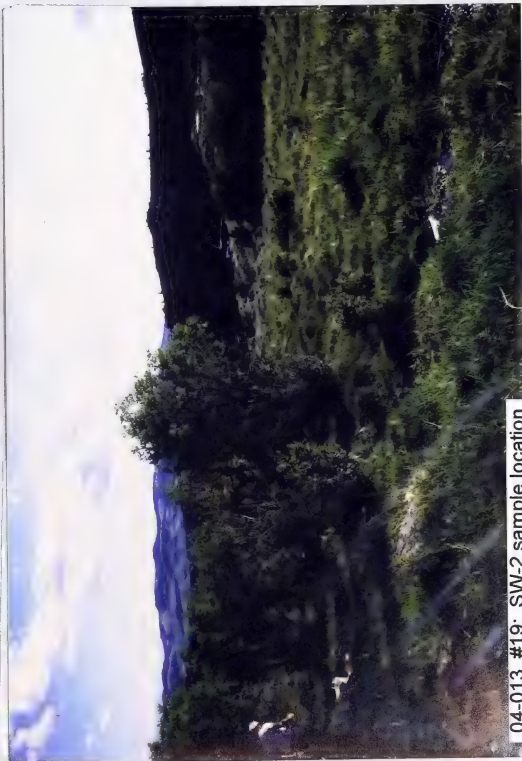
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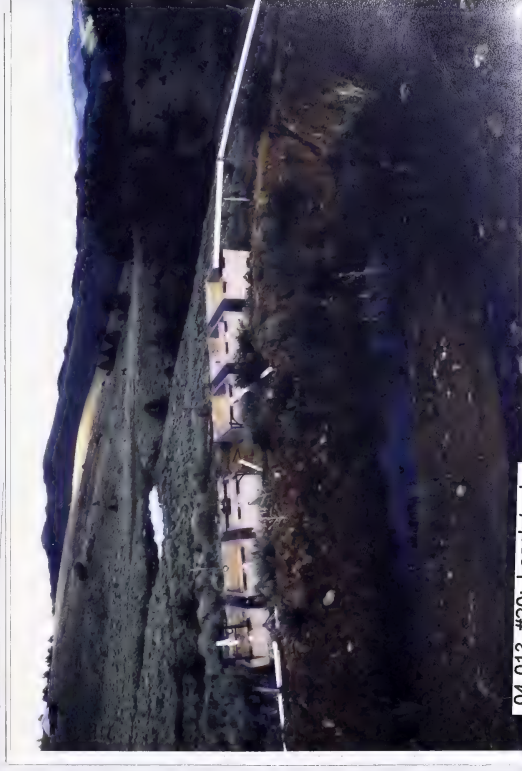
04-013, #17: SW-1 sample location



04-013, #18: Runoff path



04-013, #19: SW-2 sample location



04-013, #20: Leach tanks





04-013, #22: Open cut



04-013, #21: Pregnant pond

MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: DIAMOND HILL PA#: 04-020

Date: July 28, 1993 Time: 1230

Field Team Leader: Babits, Pioneer

Sampling Personnel: Flammang, Pioneer  
Lasher, Pioneer

Visitors: None

Weather/Seasonality Observations: Clear; warm (up to 70°F);  
slight breeze (5-10 mph); cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #22: Adit #3; #23:  
Adit #4; #1: Mill stone foundation. Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms):  
Site accessed by truck. Signs of recent exploration all over the  
site; drill pads and trenching. New roads have also been built.  
Tailings have been used in the road for approx. 240' about 600'  
southeast of the mill. Two other mills are located in Diamond  
Hill District; one approx. 0.25 mile to the south on an unnamed  
tributary of West Fork of Indian Creek, the other is approx. 0.75  
mile to the north on Indian Creek.

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Fill in pits  
with waste rock.





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): DIAMOND HILL PA#: 04-020

Legal Description: T 7N ; R 1W ; Sec. 36 , SW1/4 NW1/4 1/4

County: BROADWATER Mining District: INDIAN CREEK

Latitude: N 46° 18' 48" Longitude: W 111° 40' 38"

Primary Drainage Basin and Code: Indian Creek/10030101

Secondary Drainage Basin: West Fork Indian Creek

USGS Quadrangle map name(s): Giant Hill

Mine Type/Commodities: Hardrock/Gold

Activity Status: Active     , Inactive/Exploration X , Abandoned     .

Ownership status: Known YX N ; private/public? Private/Public  
Owner, Agent, or Contact (Include address and phone when available): Donald and Charles Smith, c/o Pegasus Gold Corporation, 300 Holmes Avenue, Butte, MT 59701. (406) 782-4200; Charlotte Engh, c/o Broadwater Developments, Inc., Pegasus Gold Corporation, North 9 Post, Spokane, WA 99201. (509) 624-4653; Helena National Forest.

Relationship to other mines/sites in the area/district: Many  
mines are located in the district.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? Reseeding has taken place on many roads.

General site features: Elevation 5400'-5900' , Slope Approx. 20° ,  
Aspect South and West

Land use: Mining X , Recreational     , Residential     , Urban     ,  
Agricultural     , Other (Specify)    

Area of disturbed/unvegetated lands? 3     acres.  
Dimensions:    

Predominant vegetation types: Sagebrush, grasses, Douglas fir

Access: roads - good X , poor     , 4wd X , trail     .  
Other logistical considerations (proximity to other sites).

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MBMG Well Log Printout(s): There are 13 well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). The 120-stamp mill lies on the perennial  
West Fork Indian Creek which flows southeast past the site to the  
confluence with Indian Creek approx. 1/2 mile away. Groundwater  
near the upper end of the site is fairly shallow, 8.1' bgs as  
measured in a nearby monitoring well. Deposit is replacement and  
fracture filling lode in andesite intruded by dikes of aplite and  
quartz monzonite.

Mining/milling history, ore type/tenor, host rock, gangue: First  
claim in early 1870's. In 1897, 120-stamp amalgamation mill was  
built on the site. In 1949, only a small part of working was  
accessible. Ore is silicified and bleached andesite containing  
pyrite, limonite, scheelite and native gold; tetradymite abismuth  
telluride also occurs. Average metal recovering during late 1940's  
is between 0.10 and 0.50 oz./ton. Tungsten content is not more  
than 0.1 percent WO3.

Mine Operation?

Shafts - Yes X, No   , # 3, Comment All open in bottom of  
facet pit

Adits - Yes X, No   , # 9, Comment 1 caved; rest are open or  
partially caved

Pits - Yes X, No   , # 6, Comment Some associated with  
shafts and adits; all  
accessible

Placers - Yes   , No X, #   , Comment   

Other - Yes   , No X, #   , Comment   

Mill Operation? Yes X, No   . If yes answer the next three  
questions:

Period(s) of Operation: 1897 to Unknown

Origin of Ore Milled - Custom Mill    Dedicated Mill X; Number and  
names of mines that supplied mill feed: Literature does not  
indicate any custom milling occurred.

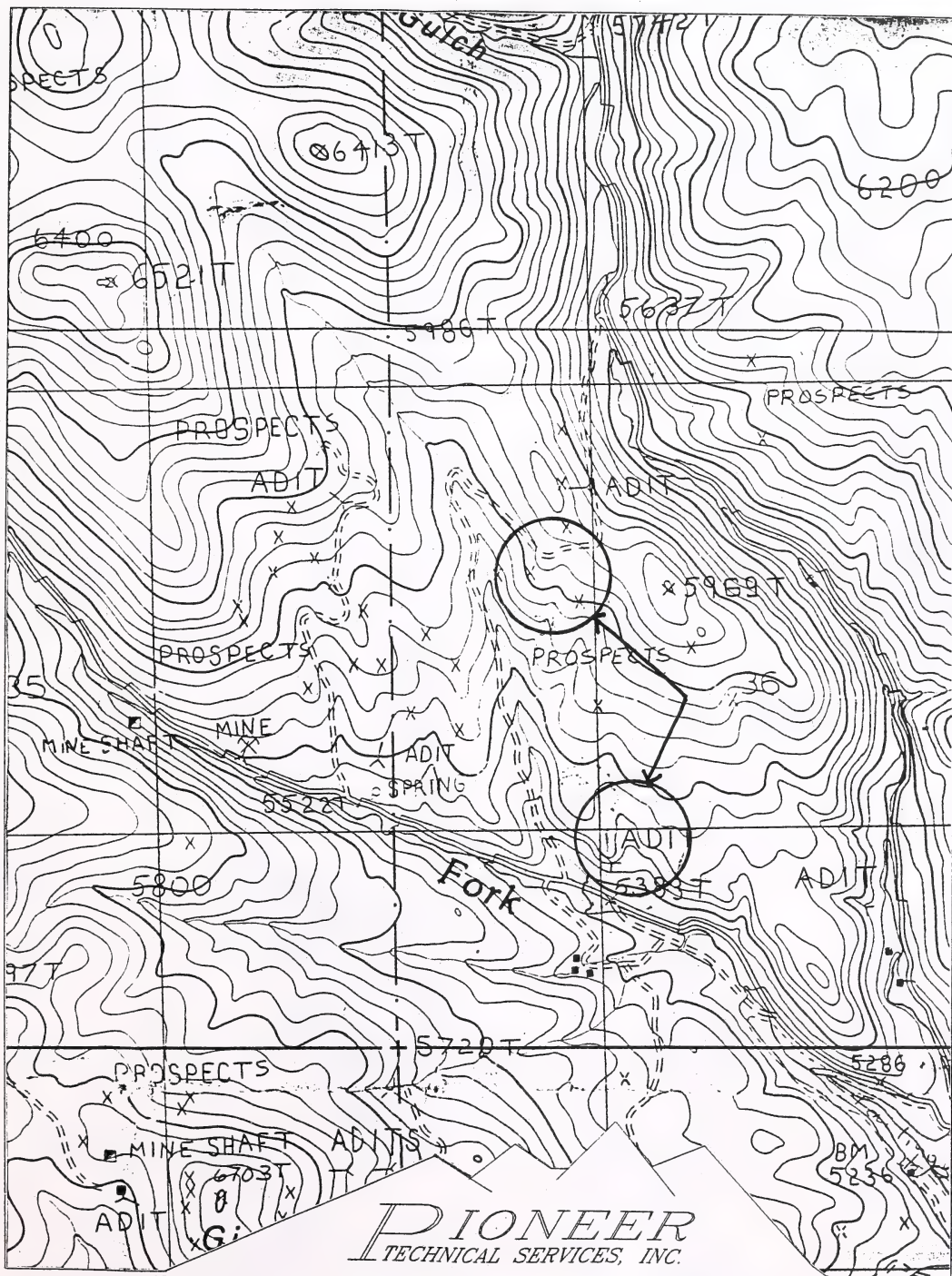
Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
Amalgamation mill

Montana Bureau of Mines and Geology  
Water Well Log Data

11/05/1993

Well No.	Location	Depth	Yield	Static Water Level
M:55739	07N 01W 36 B	33.0	0.0	11.00
M:55740	07N 01W 36 C	62.0	0.0	43.00
M:55741	07N 01W 36 D	35.0	0.0	27.00
M:19218	07N 01E 30	38.0	30.0	13.00
M:19217	07N 01E 30	39.0	27.0	14.00
M:19219	07N 01E 30 CA	60.0	40.0	6.00
M:19220	07N 01E 30 CA	60.0	30.0	7.00
M:19221	07N 01E 30 DB	39.0	25.0	7.00
M:19222	07N 01E 30 DB	63.0	30.0	8.00
M:19223	07N 01E 30 DB	90.0	70.0	8.00
M:19224	07N 01E 30 DB	59.0	30.0	8.00
M:19225	07N 01E 31	37.0	30.0	5.00
M:17610	06N 01E 01 DB	70.0	15.0	2.00





**PIONEER**  
TECHNICAL SERVICES, INC.

DIAMOND HILL, P.A. NO. 04-020

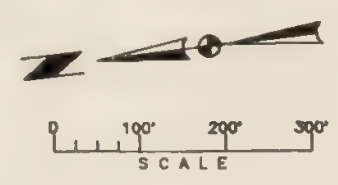
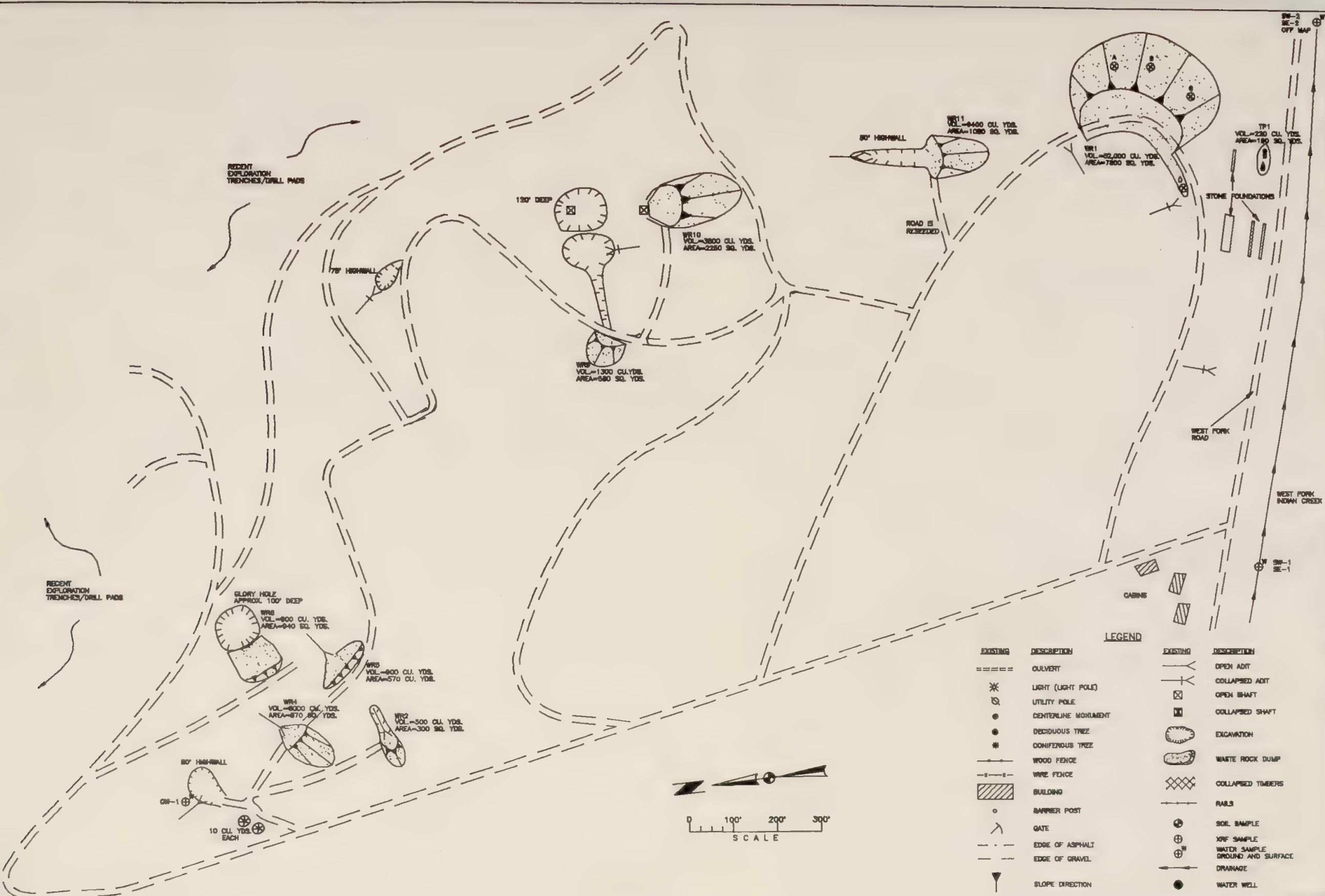
T07N, R01W, SECTION 36

SCALE: 1" = 1000'









**LEGEND**

EXISTING	DESCRIPTION	EXISTING	DESCRIPTION
=====	CULVERT	---	OPEN ADIT
*	LIGHT (LIGHT POLE)	---	COLLAPSED ADIT
o	UTILITY POLE	---	OPEN SHAFT
o	CENTERLINE MONUMENT	---	COLLAPSED SHAFT
o	DECIDUOUS TREE	---	EXCAVATION
o	CONIFEROUS TREE	---	WASTE ROCK DUMP
---	WOOD FENCE	---	COLLAPSED TIMBERS
---	WIRE FENCE	---	RAILS
---	BUILDING	---	SOIL SAMPLE
o	BARRIER POST	---	XRF SAMPLE
---	GATE	---	WATER SAMPLE
---	EDGE OF ASPHALT	---	GROUND AND SURFACE
---	EDGE OF GRAVEL	---	DRAINAGE
---	SLOPE DIRECTION	---	WATER WELL

**PIONEER**  
ENGINEERING CONSULTANTS

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS - BOZEMAN - KALISPELL  
SPokane MONTANA WASHINGTON

DRAWN: JIP DATE: 28 SEPT 93  
DESIGNED: JIP JOB NO: 04-020  
APPROVED: JIP F.B. NO:

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

DIAMOND HILL PA# 04-020  
INDIAN CREEK DISTRICT BROADWATER COUNTY

04-020.DWG SHEETS

SHEET NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): Sand and clay

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Deepest depth is 4 feet.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Moist

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): No impoundment; tails have run down side of road, across road (500'), and into new area where they are present in stream bank and floodplain for an additional approx. 375'.

Comments on potential for mitigation: Metal values and pH are low; lime, topsoil, and revegetate area by mill.



## SOURCE INVENTORY FORM

SAMPLERS: Babits, Flammang

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAIN- MENT	PH SU (D/S)*	RADIO- ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/ TIME	ANALYSES
WR-1A	WR	52,000	East end of WR-1 near peak on south side	None	6.5 (D)	0.05	04-020-WR-1	07/28/93 1100	T-Metals, ABA
WR-1B	WR		Near middle of WR-1, approx. 3' from top, 90' west of WR-1A	None	5.8 (D)	0.04			
WR-1C	WR		Immediately above east end of 20' retaining wall east of collapsed adit	Stone retaining wall at bottom	5.6 (D)	0.05			
WR-1D	WR		South of size pit	None	5.0 (D)	0.05			
WR-2	WR	500	Southeast of Adit #2	None	5.7 (D)	0.05	04-020-WR-2	07/28/93 1105	T-Metals, ABA
WR-4	WR	6,000	South and west of Adit #4, near top of 2nd tier from bottom of WR-4	None	5.7 (D)	0.04			
WR-5	WR	900	Northwest of Adit #5, approx. 3' below flat area that Adit #2 is below	None	5.4 (D)	0.04			
WR-6	WR	900	Slightly north of glory hole and 3' off of road	None	6.7 (D)	0.05			
WR-9	WR	1,300	Across from facet pit below loadout approx. 15' from top	None	6.8 (D)	0.07			
WR-11	WR	9,400	South and slightly east of Adit #11, on east side of WR-11 near top	None	6.6 (D)	0.05			
TP-1A-A	TAIL	220	Pond below mill foundation; orange/brown sand, 0'-2'	None	4.6 (D)	0.04	04-020-TP-1	07/28/93 2100	T-Metals, ABA
TP-1A-B	TAIL		Pond below mill foundation; orange/brown clay, 2'-3'	None	3.8 (D)	0.05			
TP-1B-A	TAIL		Pond below mill foundation; orange/brown sand, 0'-3'	None	5.2 (D)	0.05			
TP-1B-B	TAIL		Pond below mill foundation; orange/brown sand, 3'-4'	None	5.2 (D)	0.05			

\*Direct reading (dry Meter), B-Saturated Paste (Gins Meter)

Comments or deviations from SOPs: 04-020-WR-1 is composite of WR-1A through -1D. 04-020-WR-2 is composite of WR-2, -4, -5, -6, -9, and -11. 04-020-TP-1 is composite of TP-1A-A and -1A-B, and TP-1B-A and -1B-B.



## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_

Filled shafts: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_

Seeps/Springs: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_

Groundwater wells within 4 miles?: Yes X, No\_\_\_;  
Number of well logs: 22

Distance to nearest well used for drinking? 0.5 mile

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite\_\_\_, Probable\_\_\_, Possible\_\_\_, Unlikely X.

Metals values of dumps and tailings are fairly low; very little water on site.

Other observations/notes: Monitoring well present southwest of Engh Pit (near pit opening) was sampled.



**SAMPLERS:** Babits, Flammanq, Lasher

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft; seep or spring?**

 Comments or Deviations from the SOPs (Pioneer SAP, 1993): |

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): West Fork Indian Creek

Dry streambeds: Yes     , No X, Name(s):                     

Other surface water: Yes X, No     , Name(s)/Description: Pond approx. 750' from mill site, near end of visible tailings

Waste materials within any floodplain: Yes X, No      Source ID(s): TP-1

Approximate Flood frequency? X 1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)? 0.6 cfs

High Flow: 10 cfs, Average Flow: 1 cfs

Distance between waste source(s) and nearest surface water body (ft)? TP-1 near mill site stream is approx. 50' south of tailings. In washout area, tailings are next to the stream approx. 5'.

Surface water draining onto or through waste sources: Yes X, No     , Describe: Runoff from site drains across all waste rock and TP-1. West Fork Indian Creek may run across tailings in washout areas.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?) Agriculture; possibly industrial; mining

Observed erosional/sedimentation/stream turbidity problems? Yes X, No     , Distance downstream (ft)? N/A Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): A large-scale dredging operation has occurred approx. 600' below SW-1 sample location. Sedimentation problems in the past cannot be determined because of the new 50'-75' chasm created. A pond has been created approx. 950' from mill site near the end of visible tailings. Water from West Fork Indian Creek is collected in the pond and then drained underground for approx. 280' where it reappears as seeps in the base of the dredge gorge. Remnants of a pipe are present in the gorge and may have carried the water at one time. Any turbidity due to the site cannot be evaluated due to this.

**SAMPLERS:** Flammanq, Babits

[illegible]

**FLOW: Estimated (E) or Measured (M)?**

**Comments or Deviations from the SOPs (Pioneer SAP, 1993):** NM = Not Measured



## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? Area where pond is located and before dredge gorge

Wetlands present: Yes X, No     , Describe: Wetlands/swampy area along West Fork Indian Creek up to 10 feet on either side

Carbonate rocks/soils: Yes X, No     , Describe: Soils contained CaCO<sub>3</sub>.

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10     ; 10-30 X; 30-100     ; 100-300     ; 300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ; Comments     

Nearest residence(ft or miles)? Approx. 1/4 mile to south; several part-time houses nearby

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none

**ACID DRAINAGE/AIR PATHWAY INVENTORY FORM**

SAMPLERS: Babits, Flammang, Lasher

SOURCE I.D. NO.	ACID NINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL(OBSERVED/HIGH /MODERATE/LOW/NONE)
TP-1	pH	Moist	1,710	1,710	Yes	Moderate
WR-1	SO3	Dry	70,200	63,180	Yes	Low
WR-2	SO3	Dry	2,700	1,755	No	None
WR-4	SO3	Dry	7,830	5,875	No	None
WR-5	SO3	Dry	5,130	4,100	No	None
WR-6	None	Dry	8,460	5,075	No	None
WR-9	SO3	Dry	5,220	4,175	No	None
WR-10	SO3	Dry	20,250	20,050	Yes	Low
WR-11	SO3	Dry	9,720	9,720	Yes	Low

Notes and Clarifications:

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe:

Evidence of recreational use on site: Yes , No X , Describe:

State or National Parks - Yes ☐, No ☒, Comment \_\_\_\_\_  
 Wilderness Area - Yes ☐, No ☒, Comment \_\_\_\_\_  
 T&E Species Habitat - Yes ☐, No ☒, Comment \_\_\_\_\_  
 Bat Habitat - Yes ☒, No ☐, Comment Open adits

Riparian Habitat Quality - High\_\_\_, Medium X, Low\_\_\_  
Wetlands Frontage - High\_\_\_, Medium X, Low\_\_\_  
Fisheries Habitat and Species Classification - 4  
Sport Fishery Classification - 5

Hazardous openings: Yes X, No     , Number 12, types and locations: Adits #1 and #2, large openings; Adits #3 and #4, 3'x3' openings; Glory Hole #6 is very deep; Adit #8, small opening; Shafts 9A, 9B, and 10, as well as Facet and Tiger pits; pits approx. 120' deep with open shafts in bottom; #11 fire pit has a 50' headwall.

Unstable highwalls, pits, trenches, slopes: Yes X, No     , Number     ,  
types and locations: De' Beers, Facet, Tiger, and Fire Pits, and  
Glory Hole #6 have undercutting caving on some of their edges.

Unstable waste piles, impoundments, undercut banks: Yes X, No     ,  
Number 3, types and locations: WR-1, -10, and -11 have steep  
unvegetated slopes at angle of repose.

Fire and/or Explosion hazards: Yes , No X , Explain:



## Bibliography

- MBMG, Mines and Mineral Deposits (Except Fuels), Broadwater County, Montana, Information Circular 7592, Written by Glenn C. Reed, April 1951.
- MBMG, Well Log Database, September 8, 1993.
- MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.
- MDHES, Sample Analysis Report, Prepared by U.S. Forest Service, Townsend Office, June 14, 1993.
- MDSL/AMRB Files, Abandoned Mine Lands Portal Inventory Form for Diamond Hill, Prepared by Daphne Diggrindakis, September 27, 1982.
- MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Diamond Hill, Prepared by Northern Engineering and Testing, May 24, 1988.
- Renewable Technologies, Inc., Cultural Resource Inventory Form, Site Number 24BW741, Diamond Hill Mine and Mill, Prepared for Pegasus Gold, May 1990.
- USGS, Topographic Map, Giant Hill, Montana, 7 1/2 minute Quadrangle, 1986.



LABORATORY ANALYTICAL DATA

DIAMOND HILL  
PA NO. 04-020



Diamond Hill PA# 04-020  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BABITS  
INVESTIGATION DATE: 07/28/93

# SOLID MATRIX ANALYSES

## Results per dry weight basis

## Metals in soils

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
04-020-SE-1	78 J	165	2	20.6 J	12 J	107 J	39400	0.158 J	419 J	13 J	285	11 UU	300 J	0.622 U
04-020-SE-2	20 J	75.8	0.6 U	9.4 J	8 J	120 J	27000	0.528 J	226 J	3 J	36	9 J	49 J	0.335 U
04-020-TP-1	44 J	73	1.3	14.3 J	3 J	181 J	51200	3.38 J	366 J	2 UU	15	6 UU	46 J	0.291 U
04-020-WR-1	23 J	56.8	0.9	5.8 J	5 J	67.4 J	52400	0.61 J	119 J	17 J	14	7 UU	7 J	NR
04-020-WR-2	76 J	55.4	0.5	18.4 J	3 J	88.7 J	39200	0.369 J	526 J	3 J	13	5 UU	47 J	NR
BACKGROUND	44 J	315	1 U	24 J	15 J	28.9 J	37600	0.088 J	1220 J	9 J	31	11 UU	112 J	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

## Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL ACID BASE %	NEUTRAL POTENT. 1/1000	SULFUR ACID BASE POTENT. 1/1000	ORGANIC SULFUR %	PYRITIC SULFUR %	PYRITIC SULFUR ACID BASE POTENT. 1/1000	SULFUR ACID BASE POTENT. 1/1000
04-020-TP-1	1.29	40.3	7.45	-32.9	0.07	0.09	2.81	4.64
04-020-WR-1	2.64	82.5	-1.86	-84.3	0.10	0.02	0.62	-2.49
04-020-WR-2	0.97	30.3	12.2	-18.1	0.06	0.02	0.62	11.6

# WATER MATRIX ANALYSES

## Metals in Water

## Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CAL.C. (mg CaCO3/L)
04-020-GW-1	1.69 U	22.3	2.57 U	9.7 U	6.83 U	5.27 J	23 J	0.072	4.08 U	12.7 U	1.55 U	30.7 U	23.5 JX	232
04-020-GW-2	3.03	22.4	2.57 U	9.7 U	6.83 U	5.33 J	23 J	0.1	4.08 U	12.7 U	1.55 U	30.7 U	17.7 JX	239
04-020-SW-1	4.62	20.8	2.57 U	9.7 U	6.83 U	5.47 J	310 J	0.096	31.4	12.7 U	6.36	30.7 U	22.4 JX	96.8
04-020-SW-2	4.37	20.2	2.57 U	9.7 U	6.83 U	5.1 J	211 J	0.12	13.6	12.7 U	3.73	30.7 U	18.5 JX	103

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

## Wet Chemistry

## Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
04-020-GW-1	375	6.7	98	0.82	NR
04-020-GW-2	385	7.2	99	0.79	NR
04-020-SW-1	188	< 5.0	37	0.05	< 0.00
04-020-SW-2	195	< 5.0	38	< 0.05	< 0.00

## LEGEND

SE1 - Upgradient on West Fork Indian Creek.  
SE2 - Downgradient on West Fork Indian Creek.  
TP1 - Composite of subsamples TP1A-A, B, TP1B-A, and B.  
WR1 - Composite of subsamples WR1A, 1B, 1C, and 1D.  
WR2 - Composite of subsamples WR2, WRA, WR6, WR9, and WR11.  
BACKGROUND - From Pat (Marietta) (04-012-SS1).

GW1 - Monitoring well at mouth of Engh Pt by adit 3.  
GW2 - Duplicate of GW1.  
SW1 - Same as SE1.  
SW2 - Same as SE2.





**XRF ANALYSIS RESULTS**

**DIAMOND HILL  
PA NO. 04-020**



XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
04-020-SE-3	13881.5	19973	3283.03	979.277 *	42235.4	1297.56 *	68259		274.325	43.1705 *	42.4256 *	759.579
04-020-TP1A-A	20804	65346.8	2383.83	1297.56 *	68259	664.039 *	77498.8			68.9652 *	61.1517 *	385.565
04-020-TP1A-B	41031.6	14735.7	3346.08	664.039 *	77498.8	981.691 *	65902.6	808.539 *	399.913	86.0296 *	35.4644 *	305.424
04-020-TP1B-A	19203.5	74912.7	2140.87	185.912 *		1038.98 *	66418.8			113.477 *	74.8196 *	446.545
04-020-TP1B-B	15604.2	84896.3	2003.19	1038.98 *		1149.62 *	60182.2			72.2583 *	81.983 *	411.813
04-020-TP-1-COMP	15899.8	70037.1	1753.85	1149.62 *		529.359 *	10960.8			62.8232 *	100.955 *	386.07
04-020-WR1-A	5912.82	70603.2	2649.32	529.359 *		655.243 *	81060.4			47.9492 *	64.2638 *	383.474
04-020-WR1-B	14616	20275.3	2541.06	655.243 *			133796			66.7012 *	93.5779 *	630.383
04-020-WR1-D	14199.6	26243.9	2158.3				57283.3			40.9026 *	60.2268 *	227.217
04-020-WR-11	17416.7	42711.4	4150.17	345.5 *			55226.5	553.5	122.5	62.5 *	33.4816 *	392.824
04-020-WR-1C	15998.5	16711.5	2604.5	576.967 *			87126.3		85.4095 *	47.2085 *	57.165 *	482.191
04-020-WR-1-COMP	11756.1	30606	2297.07	814.056 *			78957			65.8639 *	196.559	450.068
04-020-WR-2	9271.95	50275	1649.08	1379.53			64179.3		108.929 *	75.8471 *	53.0818 *	612.089
04-020-WR-2-COMP	16644	40892.3	2682.11	3120.81			69869.2	437.068 *	84.1471 *	142.749 *	89.7273 *	503.023
04-020-WR-4	11470.2	32500.9	2084.17	165.648 *			49045			134.145 *	35.5271 *	814.221
04-020-WR-5	11652.3	37064.6	2690.63	1318.1			59039.5		178.205 *	108.683 *	50.2737 *	624.819
04-020-WR-6	10170.7	29955.3	2589.24	1417.64			64480.7			75.7602 *		645.753
04-020-WR-9	28581.3	26075.1	1490.64	1647.87								
Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th		
04-020-SE-3	155.805	5.65576 *	24.897 *	83.4129	164.829 *		776.993	80.9977 *		10.0478 *		
04-020-TP1A-A	133.83			61.7196			720.727	126.486 *		6.47282 *		
04-020-TP1A-B	174.854			128.848			1569.17	164.945 *		7.0802 *		
04-020-TP1B-A	110.241			62.3211	158.885 *		482.231	118.642 *		9.38183 *		
04-020-TP1B-B	109.561			52.0188			404.701	116.276 *				
04-020-TP-1-COMP	115.931			61.7148			608.495	109.79 *				
04-020-WR1-A	79.8663	11.1805 *		45.7695 *			524.967					
04-020-WR1-B	153.847			62.3372			739.485	88.961 *		8.27205 *		
04-020-WR1-D	110.687			66.2498			699.427	84.674 *		6.05379 *		
04-020-WR-11	106.984			108.525			2315.48					
04-020-WR-1C	159.5	19.5 *	13.5	71.5	112.5		716.5	91.5	5.5	8.5		
04-020-WR-1-COMP	127.84	4.97193 *		56.8087	147.534 *		619.991					
04-020-WR-2	87.8235		32.0555 *	42.6083 *			405.545	85.5349 *		5.77998 *		
04-020-WR-2-COMP	133.435		20.5467 *	69.2335			943.257					
04-020-WR-4	98.6546		19.9129 *	61.3609			513.467					
04-020-WR-5	129.527			40.5833 *	130.883 *		642.499	78.8278 *		5.73045 *		
04-020-WR-6	111.158		28.0247 *	28.0247 *			600.873			8.52595 *		
04-020-WR-9	154.442			100.354	169.328 *		1564.35			8.92616 *		

\* - Estimated Quantity

\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

DIAMOND HILL  
PA NO. 04-020





# **AIMSS SCORESHEET**

SITE NAME:

DIAMOND HILL

PA NUMBER:

04-020

LINE NO.				
1		<b>GROUNDWATER PATHWAY</b>		
2		OBSERVED RELEASE		0
3A	GW - LIKELIHOOD	EXCEEDENCES		0
3B	OF RELEASE	CONTAINMENT		20
3C		GW DEPTH		20
4		POTENTIAL TO RELEASE	LINES 3A x 3B	400
5		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
6	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.579
7		WELLS - 1 MI. x 2.5		32.5
8	GW - TARGETS	WELLS - 1 TO 4 MI		9
9		NEAREST WELL		5
10		TARGETS SCORE	LINES 6 + 7 + 8	46.5
		<b>GROUNDWATER SCORE</b>	LINES 4 x 5 x 9	10769

11		<b>SURFACE WATER PATHWAY</b>		
12		OBSERVED RELEASE		300
13A	SW - LIKELIHOOD	EXCEEDENCES		0
13B	OF RELEASE	CONTAINMENT		20
13C		DISTANCE TO SW		10
14		POTENTIAL TO RELEASE	LINES 13A x 13B	200
15		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	500
16	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.077
17		DRINKING WATER POP'N		0
18		IMPACTED DRAINAGE		1
19	SW - TARGETS	WETLANDS		0
20		FISHERY		1
21		RECREATION		0
22		IRRIGATION/STOCK		2
23		T & E SPECIES HABITAT		0
24		TARGETS SCORE	SUM LINES 16 - 22	4
		<b>SURFACE WATER SCORE</b>	LINES 14 x 15 x 23	2154

25		<b>AIR PATHWAY</b>		
26A	AIR - LIKELIHOOD	OBSERVED RELEASE		0
26B	OF RELEASE	CONTAINMENT		15
26C		DISTANCE TO POPULATION		10
27		POTENTIAL TO RELEASE	LINES 26A x 26B	150
28		LIKELIHOOD SCORE	LINES 25 + 26C	150
29	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.006
30		POPULATION - 4 MILES		10
31	AIR - TARGETS	NEAREST RESIDENCE		5
32		WETLANDS		10
33		PARKS / WILDERNESS		0
34		T & E SPECIES HABITAT		0
35		TARGETS SCORE	SUM LINES 29 - 33	25
		<b>AIR PATHWAY SCORE</b>	LINES 27 x 28 x 34	23

36		<b>DIRECT CONTACT PATHWAY</b>		
37A	LIKELIHOOD OF	OBSERVED EXPOSURE		0
37B	EXPOSURE	ACCESSIBILITY		10
37C		DISTANCE TO POPULATION		10
38		POTENTIAL EXPOSURE	LINES 37A x 37B	100
39		LIKELIHOOD SCORE	LINES 36 + 37C	100
40	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	0.000
41	DIRECT CONTACT	POPULATION - 1 MILE		10
42	TARGETS	NEAREST RESIDENCE		5
43		RECREATIONAL USE		0
44		TARGETS SCORE	SUM LINES 40 - 42	15
		<b>DIRECT CONTACT SCORE</b>	LINES 38 x 39 x 43	0

45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			
	(LINES 10 + 24 + 35 + 44) / 100,000			0.13

LINE  
NO.

SITE NAME:

DIAMOND HILL

PA NUMBER:

04-020

**SITE SAFETY**

1	THREAT	ACCESSIBILITY		10
2		OPEN SHAFTS	100 EA.	300
3		OPEN ADITS	50 EA.	400
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	375
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	1075
9		POPULATION - 1 MILE		10
10	TARGETS	NEAREST RESIDENCE		5
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 - 11	15
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>161.25</b>

**SUMMARY OF HISTORICAL ANALYTICAL DATA  
FROM OTHER SOURCES**

testname	sampleid	date	reported	U (S)
C9305-101623 FLUORIDE IN WATER	HELLGATE	05/20/93	0.12	MG/L
C9305-101623 IRON	HELLGATE	05/20/93	0.33	MG/L
C9305-101623 HARDNESS GRAINS PER GALLON	HELLGATE	05/20/93	17.2	G/PG
C9305-101623 TOTAL HARDNESS AS CaCO3	HELLGATE	05/20/93	294.9	MG/L
C9305-101623 BICARBONATE	HELLGATE	05/20/93	256	MG/L
C9305-101623 POTASSIUM	HELLGATE	05/20/93	0.6	MG/L
C9305-101623 MAGNESIUM	HELLGATE	05/20/93	42.1	MG/L
C9305-101623 MANGANESE	HELLGATE	05/20/93	0.023	MG/L
C9305-101623 SODIUM	HELLGATE	05/20/93	1.5	MG/L
C9305-101623 NITRATE PLUS NITRITE AS N	HELLGATE	05/20/93	0.14	MG/L
C9305-101623 ORTHO-PHOSPHORUS	HELLGATE	05/20/93	0.018	MG/L
C9305-101623 LEAD	HELLGATE	05/20/93	0.001	MG/L
C9305-101623 PH IN WATER	HELLGATE	05/20/93	8.41	UNITS
C9305-101623 SILICA IN WATER BY ICP	HELLGATE	05/20/93	9.7	MG/L
C9305-101623 SULFATE IN WATER	HELLGATE	05/20/93	46.5	MG/L
C9305-101623 SPECIFIC CONDUCTANCE	HELLGATE	05/20/93	514	UMHOS
C9305-101623 ZINC	HELLGATE	05/20/93	< 0.005	MG/L
C9305-101624 ALKALINITY IN WATER	INDIAN CR LOWER	05/21/93	28	MG/L
C9305-101624 ARSENIC	INDIAN CR LOWER	05/21/93	0.07	MG/L
C9305-101624 CALCIUM	INDIAN CR LOWER	05/21/93	20.8	MG/L
C9305-101624 CADMIUM	INDIAN CR LOWER	05/21/93	0.004	MG/L
C9305-101624 CHLORIDE IN WATER	INDIAN CR LOWER	05/21/93	< 1.0	MG/L
C9305-101624 COPPER	INDIAN CR LOWER	05/21/93	< 0.01	MG/L
C9305-101624 FLUORIDE IN WATER	INDIAN CR LOWER	05/21/93	< 0.10	MG/L
C9305-101624 IRON	INDIAN CR LOWER	05/21/93	0.46	MG/L
C9305-101624 HARDNESS GRAINS PER GALLON	INDIAN CR LOWER	05/21/93	3.7	G/PG
C9305-101624 TOTAL HARDNESS AS CaCO3	INDIAN CR LOWER	05/21/93	64.7	MG/L
C9305-101624 BICARBONATE	INDIAN CR LOWER	05/21/93	33	MG/L
C9305-101624 POTASSIUM	INDIAN CR LOWER	05/21/93	0.4	MG/L
C9305-101624 MAGNESIUM	INDIAN CR LOWER	05/21/93	3.1	MG/L
C9305-101624 MANGANESE	INDIAN CR LOWER	05/21/93	0.056	MG/L
C9305-101624 SODIUM	INDIAN CR LOWER	05/21/93	2.3	MG/L
C9305-101624 NITRATE PLUS NITRITE AS N	INDIAN CR LOWER	05/21/93	0.02	MG/L
C9305-101624 ORTHO-PHOSPHORUS	INDIAN CR LOWER	05/21/93	0.025	MG/L
C9305-101624 LEAD	INDIAN CR LOWER	05/21/93	0.01	MG/L
C9305-101624 PH IN WATER	INDIAN CR LOWER	05/21/93	7.65	UNITS
C9305-101624 SILICA IN WATER BY ICP	INDIAN CR LOWER	05/21/93	14.7	MG/L
C9305-101624 SULFATE IN WATER	INDIAN CR LOWER	05/21/93	24.6	MG/L
C9305-101624 SPECIFIC CONDUCTANCE	INDIAN CR LOWER	05/21/93	127	UMHOS
C9305-101624 ZINC	INDIAN CR LOWER	05/21/93	0.51	MG/L
C9305-101625 ALKALINITY IN WATER	INDIAN CR UPPER		14.4	MG/L
C9305-101625 ARSENIC	INDIAN CR UPPER		0.085	MG/L
C9305-101625 CALCIUM	INDIAN CR UPPER		16.9	MG/L
C9305-101625 CADMIUM	INDIAN CR UPPER		0.008	MG/L
C9305-101625 CHLORIDE IN WATER	INDIAN CR UPPER		< 1.0	MG/L
C9305-101625 COPPER	INDIAN CR UPPER		< 0.01	MG/L
C9305-101625 FLUORIDE IN WATER	INDIAN CR UPPER		< 0.10	MG/L
C9305-101625 IRON	INDIAN CR UPPER		0.6	MG/L
C9305-101625 HARDNESS GRAINS PER GALLON	INDIAN CR UPPER		3.0	G/PG

APPROVED BY: DLB

\*\*\*FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-2642

testname	sampleid	date	reported	units
C9305-101625 TOTAL HARDNESS AS CaCO <sub>3</sub>	INDIAN CR UPPER		51.7	MG/L
C9305-101625 BICARBONATE	INDIAN CR UPPER		17	MG/L
C9305-101625 POTASSIUM	INDIAN CR UPPER		0.5	MG/L
C9305-101625 MAGNESIUM	INDIAN CR UPPER		2.3	MG/L
C9305-101625 MANGANESE	INDIAN CR UPPER		0.115	MG/L
C9305-101625 SODIUM	INDIAN CR UPPER		2.1	MG/L
C9305-101625 NITRATE PLUS NITRITE AS N	INDIAN CR UPPER		0.05	MG/L
C9305-101625 ORTHO-PHOSPHORUS	INDIAN CR UPPER		0.031	MG/L
C9305-101625 LEAD	INDIAN CR UPPER		0.016	MG/L
C9305-101625 PH IN WATER	INDIAN CR UPPER		7.4	UNITS
C9305-101625 SILICA IN WATER BY ICP	INDIAN CR UPPER		14.3	MG/L
C9305-101625 SULFATE IN WATER	INDIAN CR UPPER		26.1	MG/L
C9305-101625 SPECIFIC CONDUCTANCE	INDIAN CR UPPER		100	UMHOS
C9305-101625 ZINC	INDIAN CR UPPER		0.822	MG/L
C9305-101626 ALKALINITY IN WATER	WEASEL CR. UPPER		31.6	MG/L
C9305-101626 ARSENIC	WEASEL CR. UPPER		0.034	MG/L
C9305-101626 CALCIUM	WEASEL CR. UPPER		23	MG/L
C9305-101626 CADMIUM	WEASEL CR. UPPER		0.002	MG/L
C9305-101626 CHLORIDE IN WATER	WEASEL CR. UPPER		1.1	MG/L
C9305-101626 COPPER	WEASEL CR. UPPER		< 0.01	MG/L
C9305-101626 FLUORIDE IN WATER	WEASEL CR. UPPER		< 0.10	MG/L
C9305-101626 IRON	WEASEL CR. UPPER		1.24	MG/L
C9305-101626 HARDNESS GRAINS PER GALLON	WEASEL CR. UPPER		4.1	G/PG
C9305-101626 TOTAL HARDNESS AS CaCO <sub>3</sub>	WEASEL CR. UPPER		70.6	MG/L
C9305-101626 POTASSIUM	WEASEL CR. UPPER		1.5	MG/L
C9305-101626 MAGNESIUM	WEASEL CR. UPPER		3.2	MG/L
C9305-101626 MANGANESE	WEASEL CR. UPPER		0.142	MG/L
C9305-101626 SODIUM	WEASEL CR. UPPER		3.8	MG/L
C9305-101626 NITRATE PLUS NITRITE AS N	WEASEL CR. UPPER		0.94	MG/L
C9305-101626 ORTHO-PHOSPHORUS	WEASEL CR. UPPER		0.079	MG/L
C9305-101626 LEAD	WEASEL CR. UPPER		0.034	MG/L
C9305-101626 PH IN WATER	WEASEL CR. UPPER		7.68	UNITS
C9305-101626 SILICA IN WATER BY ICP	WEASEL CR. UPPER		21.9	MG/L
C9305-101626 SULFATE IN WATER	WEASEL CR. UPPER		35	MG/L
C9305-101626 SPECIFIC CONDUCTANCE	WEASEL CR. UPPER		166	UMHOS
C9305-101626 ZINC	WEASEL CR. UPPER		0.345	MG/L

APPROVED BY: DLB

\*\*\*FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-2642







04-020, #22: Adit #3



04-020, #1: Mill foundation



04-020, #23: Adit #4







MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: OHIO PA#: 04-009

Date: September 3, 1993 Time: 0830

Field Team Leader: Bullock, Pioneer

Sampling Personnel: M. Babits, S. Babits,  
Flamming; Pioneer  
Pierson; TD&H

Visitors: Earl McCurley, MDSL/AMRB

Weather/Seasonality Observations: Warm (up to 75°); mostly clear;  
slight breeze (0-5 mph); cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #19: Millsite; #20:  
Shaft and WR-1; #21: TP-1 and TP-2; #22: WR-2.  
Video Tape No. 6

General Comments/Observations (not covered specifically in attached Inventory Forms): N/A

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Isolate  
drainage from waste materials, reduce slopes, amend, and  
revegetate. Additional study will be necessary at this site.





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): OHIO PA#: 04-009

Legal Description: T 5N ; R 1W ; Sec. 13 , NW1/4 SE1/4 1/4

County: BROADWATER Mining District: RADERSBURG

Latitude: N 46° 11' 08" Longitude: W 111° 40' 07"

Primary Drainage Basin and Code: Crow Creek/10030101

Secondary Drainage Basin: Keating Gulch

USGS Quadrangle map name(s): Radersburg

Mine Type/Commodities: Hardrock/Gold

Activity Status: Active ☐ , Inactive/Exploration ☐ , Abandoned ☒ .

Ownership status: Known ☒ N ☐ ; private/public? Private

Owner, Agent, or Contact (Include address and phone when available): Geo. Chem.

Development Corp., First National Bank Building, Butte, MT 59701.

(406) 723-5411.

Relationship to other mines/sites in the area/district: 2,300 feet west of Keatings tailings site.

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? Some areas have been fenced by MDSL/AMRB.

General site features: Elevation 4650' , Slope 5°-30° , Aspect Southeast

Land use: Mining ☒ , Recreational ☐ , Residential ☐ , Urban ☐ , Agricultural ☒ , Other (Specify)

Area of disturbed/unvegetated lands? 3 acres.

Dimensions:

Predominant vegetation types: Sage, juniper, rabbit brush, Douglas fir

Access: roads - good ☒ , poor ☐ , 4wd ☐ , trail ☐ .

Other logistical considerations (proximity to other sites). Along Keating Gulch road

Well logs within 1 mile radius; water rights 15 mi downstream (Attach MEMO Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). Keating Gulch flows west to east immediately adjacent to the site until it discharges to Crow Creek three miles downstream.

Mining/milling history, ore type/tenor, host rock, gangue: This claim was discovered shortly after 1866 worked continuously till 1943 when underground work discontinued. Mill was equipped with an electrified 90-ton gravity flotation mill and was rated at 100 ton/day. In 1949, the mine flooded to within 50' of surface. Mine and mill equipment have been dismantled. Ohio-Keating vein is a persistent fracture filling in pyritized and intensify bleached andesite. Predominant vein minerals are auriferous pyrite quartz and sparse copper sulfides in a silicified andesite gangue. Production records indicate in 1926 gold average .14 ounces/ton, and in 1935 a gold average of 1.30 ounces/ton and from 1901-1945 a gold average of .31 ounces/ton.

Mine Operation?

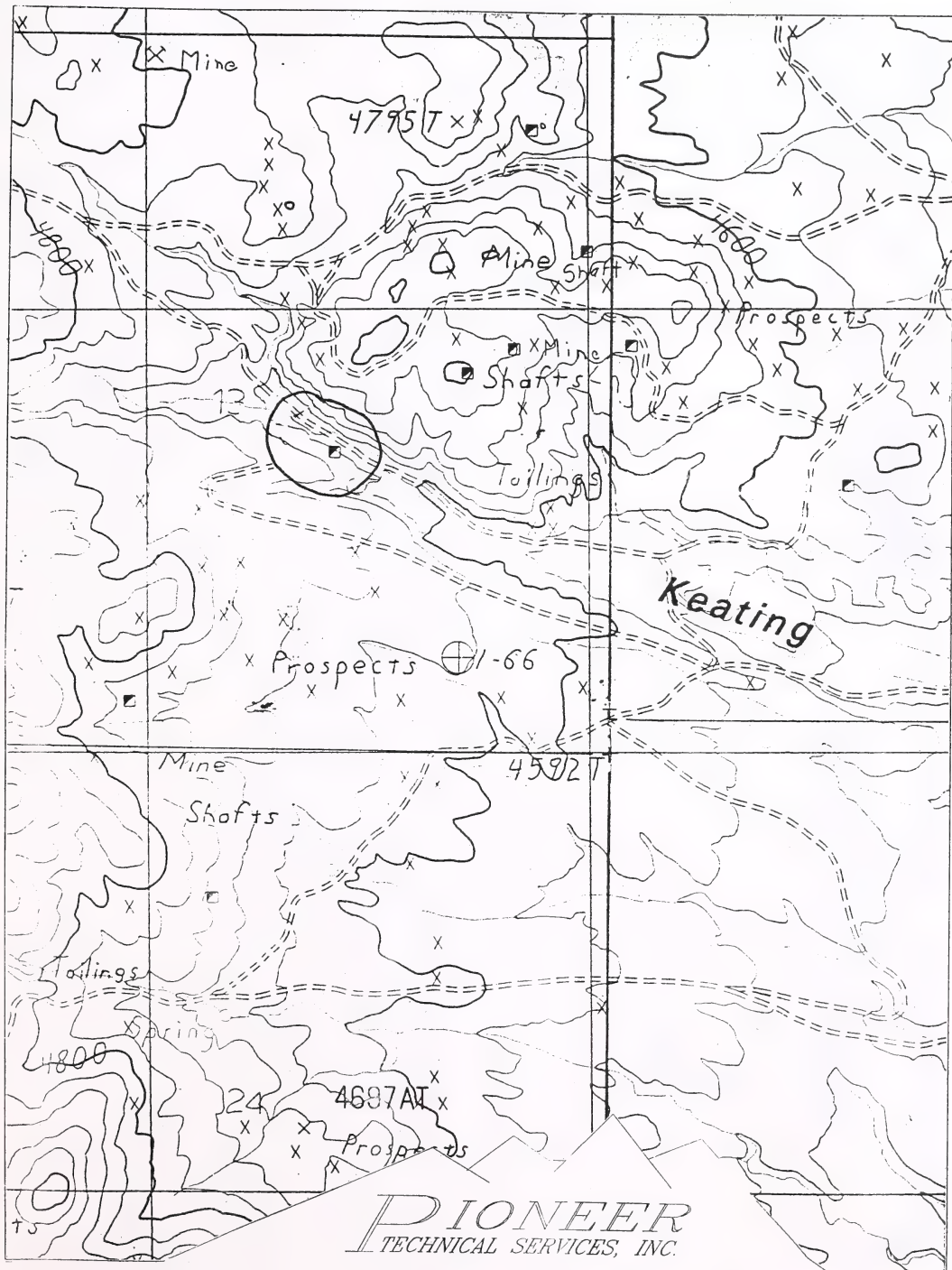
Shafts - Yes X, No    , # 1, Comment                       
Adits - Yes X, No    , # 2, Comment Open-across gulch  
Pits - Yes    , No X, #    , Comment                       
Placers - Yes    , No X, #    , Comment                       
Other - Yes    , No X, #    , Comment                     

Mill Operation? Yes X, No    . If yes answer the next three questions:

Period(s) of Operation: From 1866 to 1943

Origin of Ore Milled - Custom Mill     Dedicated Mill X; Number and names of mines that supplied mill feed:                     

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting? Gravity flotation



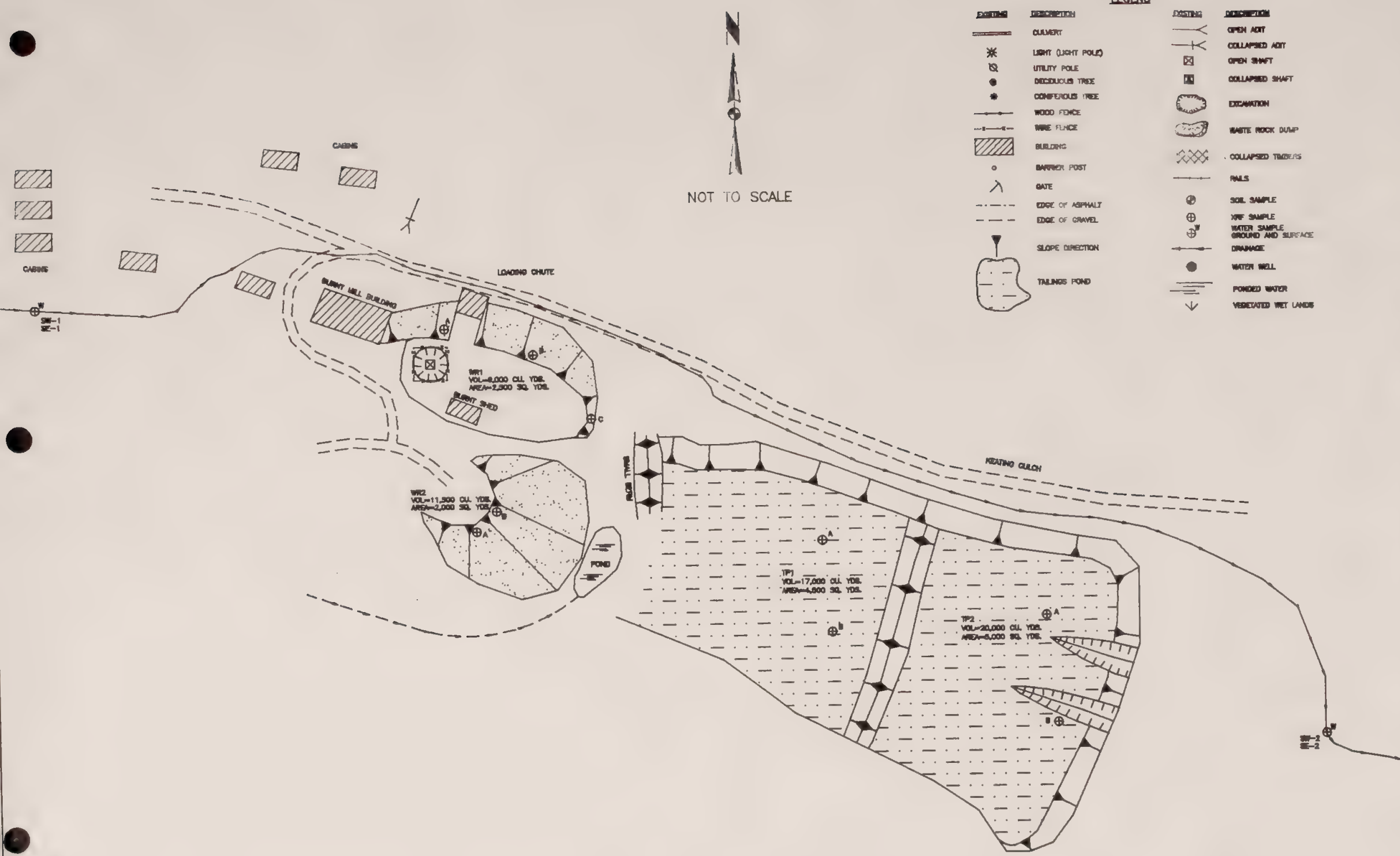
**PIONEER**  
TECHNICAL SERVICES, INC.

OHIO, P.A. NO. 04-009

T05N, R01W, SECTION 13

SCALE: 1" = 1000'





NOT TO SCALE

POSTING	DESCRIPTION	POSTING	DESCRIPTION
	CULVERT		OPEN ADIT
	LIGHT (LIGHT POLE)		COLLAPSED ADIT
	UTILITY POLE		OPEN SHAFT
	DECIDUOUS TREE		COLLAPSED SHAFT
	CONIFEROUS TREE		EXCAVATION
	WOOD FENCE		WASTE ROCK DUMP
	WIRE FENCE		COLLAPSED TIMBERS
	BUILDING		PAILS
	BARRIER POST		SOIL SAMPLE
	GATE		XRF SAMPLE
	EDGE OF ASPHALT		WATER SAMPLE
	EDGE OF GRAVEL		GROUND AND SURFACE
	SLOPE DIRECTION		DRAINAGE
	TAILINGS POND		WATER WELL
			PONDED WATER
			VEGETATED WET LANDS

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

OHIO PA#04-009  
RADARSBURG DISTRICT BROADWATER COUNTY

PIONEER  
ENGINEERING & CONSULTANTS

TD&H

DRAWN: JWC DATE: 1 DEC 93  
DESIGNED: TBR JOB NO.: 93-17  
APPROVED: JWB F.B. NO.:  
THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA  
SPOKANE WASHINGTON

SLEPSSGMD 600-10

ON LEHS





## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay):  
60% fine sand and 40% silty clay

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Both ponds are in excess of 20 feet with reduced zones between 5 and 10 feet below ground surface.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Silt and clay zones are moist, sand zones mostly dry.

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): TP-2 impoundment is eroding during significant storm events.

Comments on potential for mitigation: Remove from drainage, reduce slopes, and amend and revegetate.

# **SOURCE INVENTORY FORM**

**SAMPLERS:** Bullock, Flammang, M. Babits, S. Babits, Pierson\*

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd)	LOCATION/DESCRIPTION	CONTAINMENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
WR-1A	WR	8,000	West end of WR-1 approx. 50 feet from loadout	None	< 3.5 (D)	0.045	04-009-WR-1	09/03/93 1230	T-Metals, ABA
WR-1B	WR		Near center of WR-1, 20 feet from top in yellowish area	None	< 3.5 (D)	0.05			
WR-1C	WR		East end of WR-1 approx. 35 feet west of bushes	None	6.40 (D)	0.05			
WR-2A	WR	11,500	South side	None	< 3.5 (D)	0.04			
WR-2B	WR		Middle	None	< 3.5 (D)	0.04			
TP-1A-A	TAIL	17,000	North side of upper pond; 0-3', borehole, red/orange sand/clay	None	< 3.5 (D)	0.05	04-009-TP-1	09/03/93 1345	T-Metals, ABA
TP-1A-B	TAIL		North side of upper pond; 3-6', borehole, gray sand/clay	None	< 3.5 (D)	0.05			
TP-1A-C	TAIL		North side of upper pond; 6-12', borehole, light gray sand	None	4.6 (D)	0.03			
TP-1A-D	TAIL		North side of upper pond; 12-15', borehole, red/brown sand	None	6.0 (D)	0.06			
TP-1B-A	TAIL		South side of upper pond; 0-3', borehole, orange sand	None	4.5 (D)	0.05			
TP-1B-B	TAIL		South side of upper pond; 3-8.5', borehole, gray clay	None	5.9 (D)	0.04			
TP-1B-C	TAIL		South side of upper pond; 8.5-13.5', borehole, gray sand	None	6.1 (D)	0.05			
TP-1B-D	TAIL		South side of upper pond; 13.5-15.5', borehole, green/gray	None	5.8 (D)	0.08			

\*D-Direct reading(Kelway Meter); S-Saturated Paste(Orion Meter)

Comments or deviations from SOPs: 04-009-WR-1 is a composite of WR-1A through -1C, and WR-2A and -2B. 04-009-TP-1 is a composite of TP-1A-A through -1A-D, and TP-1B-A through -1B-D.

\*Continued on next page

# SOURCE INVENTORY FORM (Cont'd)

SAMPLERS: Flammang, Bullock, M. Babits, S. Babits, Pierson

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	pH SU (D/S)*	RADIO-ACTIVITY (mR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
TP-2A-A	TAIL	20,000	Lower pond northeast corner; 0-2', borehole, orange/tan sand	None	6.4 (D)	0.07	04-009-TP-2	09/03/93 1400	T-Metals, ABA
TP-2A-B	TAIL		Lower pond northeast corner; 2-8', borehole, brown sand	None	6.2 (D)	0.055			
TP-2A-C	TAIL		Lower pond northeast corner; 8-10', borehole, gray clay	None	6.2 (D)	0.05			
TP-2A-D	TAIL		Lower pond northeast corner; 10-15', borehole, gray sand	None	6.2 (D)	0.045			
TP-2B-A	TAIL		Lower pond south end near dam in erosion gully; 0-2', profile, orange/tan sand	None	<3.5 (D)	0.04			
TP-2B-B	TAIL		Lower pond south end near dam in erosion gully; 10-13', profile, gray clay/brown sand	None	6.3 (D)	0.035			
TP-2B-C	TAIL		Lower pond south end near dam in erosion gully; 19-21', profile, gray clay/brown sand	None	6.5 (D)	0.05			
SS-1	BKGRND	N/A	Background soil 850 feet upgradient from mill building	None	6.0 (D)	0.06	04-009-SS-1	09/03/93 1200	T-Metals,

\* Direct reading (Kilovolt Meter); B (Barred) Beta (C/cm Meter)

Comments or deviations from SOPs: 04-009-TP-2 is a composite of TP-2A-A, 2A-B, 2A-C, 2A-D, 2B-A, 2B-B, and 2B-C.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Filled shafts: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Seeps/Springs: Yes\_\_\_, No X, Number:\_\_\_ Identification:\_\_\_\_\_

Groundwater wells within 4 miles?: Yes X, No\_\_\_;  
Number of well logs: 37

Distance to nearest well used for drinking? The nearest well is 2 miles.

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite\_\_\_, Probable X, Possible\_\_\_, Unlikely\_\_\_.

Shallow alluvial groundwater is probably in contact with reactive min-  
wastes containing elevated metals levels.

Other observations/notes: N/A



### SAMPLERS:

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): Keating Gulch

Dry streambeds: Yes     , No X, Name(s):     

Other surface water: Yes X, No     , Name(s)/Description: Pond at base of WR-2

Waste materials within any floodplain: Yes X, No      Source ID(s): TP-1, TP-2 and WR-1

Approximate Flood frequency? X 1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)?     

High Flow: 5-10 cfs, Average Flow: 0.5 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet

Surface water draining onto or through waste sources: Yes     , No X, Describe:     

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Irrigation, stockwatering, fishery, wetland, T&E -Bald Eagle

Observed erosional/sedimentation/stream turbidity problems? Yes X, No     , Distance downstream (ft)? >1000' Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):       
Tailings were observed in streambed.



**SAMPLERS:** M. Babits, S. Babits

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? 50 to 60 acres between Ohio and  
Keating tailings

Wetlands present: Yes , No X , Describe:

Carbonate rocks/soils: Yes , No X , Describe:

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10\_\_\_; 10-30 X; 30-100\_\_\_;  
100-300\_\_\_; 300-1,000\_\_\_; 1,000-3,000\_\_\_; 3,000-10,000\_\_\_; 10,000 or  
greater\_\_\_; Comments

Nearest residence(ft or miles)? 2 miles

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?    Wet or dry?

Overall dust propagation potential:

observed	high	moderate	low	none
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# ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Flammang

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH /MODERATE/LOW/NONE)
WR-1	SO3; pH	Dry	22,500	22,500	Yes	Low - hardpack
WR-2	SO3; pH	Moist	18,000	18,000	Yes	Low - hardpack
TP-1	Low pH	Partial	40,500	40,500	Yes	Moderate
TP-2	Low pH	Partial	45,000	45,000	Yes	Moderate

Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X, Describe: \_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_; 300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_; Comments None

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: Motorbike tracks in tailings and waste rock. \_\_\_\_\_

Accessibility - Fences, warning signs, closed roads? Unrestricted

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment_____
Wilderness Area -	Yes____, No <u>X</u> , Comment_____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment_____
Bat Habitat -	Yes <u>X</u> , No____, Comment_____

Primary Drainage\_\_\_\_; Secondary Drainage X; No Information\_\_\_\_:

Riparian Habitat Quality -	High____, Medium____, Low <u>Not Rated</u>
Wetlands Frontage -	High____, Medium____, Low <u>Not Rated</u>
Fisheries Habitat and Species Classification -	<u>Not Rated</u>
Sport Fishery Classification -	<u>Not Rated</u>

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No\_\_\_\_, Number 2, types and locations: Adit on north side of Keating Gulch and a fenced shaft \_\_\_\_\_

Hazardous structures: Yes X, No\_\_\_\_, Number 8, types and locations: Loadout and some cabins \_\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations: \_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain: \_\_\_\_\_

## Bibliography

- MBMG, Analytical Data for the Ohio Mine, Provided by Ted Duiame, June 14, 1993.
- MBMG, Well Log Database, September 8, 1993.
- MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.
- MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Ohio, Prepared by Northern Engineering and Testing, June 15, 1988.
- MDSL/AMRB Files, Abandoned Mine Reclamation Portal Inventory for Ohio, Prepared by Daphne Digrindakis, October 8, 1984.
- USBM, Mines and Mineral Deposits (Except Fuels), Broadwater County, Montana, Information Circular 7592, Written by Glenn C. Reed, April 1951.
- USGS, Mining Districts of the Dillon Quadrangle, Montana and Adjacent Areas, Bulletin 574, Written by Alexander N. Winchell, 1914.
- USGS, Topographic Map, Radersburg, Montana, 7 1/2 minute Quadrangle, 1986.







LABORATORY ANALYTICAL DATA

OHIO  
PA NO. 04-009



Ohio PA# 04-009  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 09/03/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
04-009-SE-1	8.63 J	55.3 J	0.9 U	7.53	3.96 J	22.6	17700 J	0.058 J	355	7.59 J	30.2 J	6.12 UJ	148 J	NR
04-009-SE-2	56.4 J	56.4 J	0.8 U	12.5	4.9	75.9	35300 J	0.070 J	295	7.85 J	29.4 J	5.76 UJ	85.5 J	NR
04-009-TP-1	32.1 J	36.3 J	1.1 U	86.3	8.35	350	79600 J	0.595 J	269	8.45 J	70.9 J	7.44 UJ	333 J	NR
04-009-TP-2	203 J	54 J	1.0 U	32.2	7.41	142	46000 J	0.35 J	284	5.82 J	50.1 J	6.56 UJ	207 J	NR
04-009-WR-1		94.1 J	0.7 U	29.4	3.07	98.4	75400 J	0.622 J	27.7	1.89 J	189 J	5.13 UJ	36.1 J	NR
BACKGROUND	6.11 J	214 J	1.0 U	8.92	6.14	22.6	19200 J	0.106 J	819	7.83 J	25.2 J	6.96 UJ	79.6 J	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		SULFUR ACID BASE POTENT.		PYRITIC SULFUR		ORGANIC SULFUR		PYRITIC ACID BASE POTENT.	
	%	U/1000t	%	U/1000t	%	U/1000t	%	U/1000t	%	U/1000t
04-009-TP-1	4.85	182		36.7	-115	3.11	0.24	1.5	46.9	-10.1
04-009-TP-2	3.44	107		39.9	-67.	1.04	0.12	2.28	71.2	-31.3
04-009-WR-1	9.32	291		-15.	-307	4.3	1.95	3.07	95.9	-112

WATER MATRIX ANALYSES

Metals in Water  
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO <sub>3</sub> /L)
04-009-SW-1	1.18 U	37.9	4.59 U	5 U	6.24 U	2.33 U	34.4	0.12 U	5.4	10.9 U	0.72 U	31.7 U	11.1	309
04-009-SW-2	1.18 U	33.4	4.59 U	5 U	6.24 U	2.33 U	85.9	0.12 U	3.76 U	10.9 U	0.93	31.7 U	9.33	281

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry  
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO <sub>3</sub> /NO <sub>2</sub> -N	CYANIDE
04-009-SW-1	390	7.0	131	< 0.05	NR
04-009-SW-2	366	8.0	135	< 0.05	NR

LEGEND

- SE1 - 540 feet upgradient of mill building in Keating Gulch.  
SE2 - 400 feet downgradient in Keating Gulch.  
TP1 - Composite of subsamples TP1A-A, 2A-B, 2A-C, 2A-D, 2B-A, 2B-B, and 2B-C.  
TP2 - Composite of subsamples TP2A-A, 2A-B, 2A-C, 2A-D, 2B-A, 2B-B, and 2B-C.  
WR1 - Composite of subsamples WR1A through 1C, 2A, and 2B.  
BACKGROUND - 850 feet upgradient from mill building.  
From the Ohio Mine (04-009-SS-1).
- SW1 - Same as sample SE1.  
SW2 - Same as sample SE2.



**XRF ANALYSIS RESULTS**

**OHIO  
PA NO. 04-009**

04-009-WR-1-COMP



## XRF Field Analyses

Results in PPM

Page 2 of 2.

XRF SAMPLE ID	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th
04-009-SS-1	182.433				82.2134			371.803		25.637 *	30.3107
04-009-TP1A-A	118.696		13.317 *	54.4901 *	263.703			933.497			
04-009-TP1A-B	87.1258		13.2888 *	40.5508 *	213.726			1031.28			
04-009-TP1A-C	115.031		11.7158 *	23.1764 *	262.568			1345.8			
04-009-TP1A-D	133.007		9.49837 *		298.459			1824.31		13.1447 *	
04-009-TP1A-D-DUP	127.51		11.4746 *		318.77			1873.07			
04-009-TP1B-A	115.302		6.07574 *	36.4812 *	223.439			1044.75			
04-009-TP1B-B	100.292		4.66137 *	34.1605 *	206.128			923.795			
04-009-TP1B-C	133.268			15.8123 *	264.855			1444.57			
04-009-TP1B-C-DUP	137.035		5.54321 *	19.7665 *	251.103			1411.49		12.2861 *	
04-009-TP1B-D	135.674	39.1859 *			256.005	189.189 *		1636.41			
04-009-TP2A-A	129.477		5.20524 *		259.093			1311.28			
04-009-TP2A-B											
04-009-TP2A-C	116.074	37.1763 *		21.4947 *	220.831	175.942 *		1099.3			
04-009-TP2A-D	132.236				260.589			1545.89	95.7783 *		
04-009-TP2B-A	125.978		6.42896 *		224.832			1287.95			
04-009-TP2B-B	125.791			25.5431 *	185.54			942.201			
04-009-TP2B-C	173.875		4.39323 *	40.1913 *	179.038			1005.11			
04-009-TP-1-COMP	137.37			24.2673 *	248.859	221.471 *		1462.27			
04-009-TP-2-COMP	123.821			23.7417 *	235.779			1484.12	107.126 *		7.46003 *
04-009-WR1-A	75.1673		10.8672 *	100.43	138.714			944.206			
04-009-WR1-B	115.523		8.98721 *	214.883	209.969			1399.12			
04-009-WR1-C	83.5463		9.38164 *	35.3778 *	173.927			878.82			
04-009-WR2-A	59.3966		11.4968 *	29.802 *	96.5435			645.204			
04-009-WR2-B	87.274		12.9029 *	32.436 *	168.683			862.922			
04-009-WR-1-COMP	90.4706		10.6535 *	177.756	151.441			906.78			

\$ - Unvalidated Data

\* - Estimated Quantity



**SUMMARY OF HISTORICAL ANALYTICAL DATA  
FROM OTHER SOURCES**

June 14, 1993

testname	sampleid	date	reported	units
C9305-101623 FLUORIDE IN WATER	HELLGATE	05/20/93	0.12	MG/L
C9305-101623 IRON	HELLGATE	05/20/93	0.33	MG/L
C9305-101623 HARDNESS GRAINS PER GALLON	HELLGATE	05/20/93	17.2	G/PG
C9305-101623 TOTAL HARDNESS AS CaCO3	HELLGATE	05/20/93	294.9	MG/L
C9305-101623 BICARBONATE	HELLGATE	05/20/93	256	MG/L
C9305-101623 POTASSIUM	HELLGATE	05/20/93	0.6	MG/L
C9305-101623 MAGNESIUM	HELLGATE	05/20/93	42.1	MG/L
C9305-101623 MANGANESE	HELLGATE	05/20/93	0.023	MG/L
C9305-101623 SODIUM	HELLGATE	05/20/93	1.5	MG/L
C9305-101623 NITRATE PLUS NITRITE AS N	HELLGATE	05/20/93	0.14	MG/L
C9305-101623 ORTHO-PHOSPHORUS	HELLGATE	05/20/93	0.018	MG/L
C9305-101623 LEAD	HELLGATE	05/20/93	0.001	MG/L
C9305-101623 PH IN WATER	HELLGATE	05/20/93	8.41	UNITS
C9305-101623 SILICA IN WATER BY ICP	HELLGATE	05/20/93	9.7	MG/L
C9305-101623 SULFATE IN WATER	HELLGATE	05/20/93	46.5	MG/L
C9305-101623 SPECIFIC CONDUCTANCE	HELLGATE	05/20/93	514	UMHOS
C9305-101623 ZINC	HELLGATE	05/20/93	< 0.005	MG/L
C9305-101624 ALKALINITY IN WATER	INDIAN CR LOWER	05/21/93	28	MG/L
C9305-101624 ARSENIC	INDIAN CR LOWER	05/21/93	0.07	MG/L
C9305-101624 CALCIUM	INDIAN CR LOWER	05/21/93	20.8	MG/L
C9305-101624 CADMIUM	INDIAN CR LOWER	05/21/93	0.004	MG/L
C9305-101624 CHLORIDE IN WATER	INDIAN CR LOWER	05/21/93	< 1.0	MG/L
C9305-101624 COPPER	INDIAN CR LOWER	05/21/93	< 0.01	MG/L
C9305-101624 FLUORIDE IN WATER	INDIAN CR LOWER	05/21/93	< 0.10	MG/L
C9305-101624 IRON	INDIAN CR LOWER	05/21/93	0.46	MG/L
C9305-101624 HARDNESS GRAINS PER GALLON	INDIAN CR LOWER	05/21/93	3.7	G/PG
C9305-101624 TOTAL HARDNESS AS CaCO3	INDIAN CR LOWER	05/21/93	64.7	MG/L
C9305-101624 BICARBONATE	INDIAN CR LOWER	05/21/93	33	MG/L
C9305-101624 POTASSIUM	INDIAN CR LOWER	05/21/93	0.4	MG/L
C9305-101624 MAGNESIUM	INDIAN CR LOWER	05/21/93	3.1	MG/L
C9305-101624 MANGANESE	INDIAN CR LOWER	05/21/93	0.056	MG/L
C9305-101624 SODIUM	INDIAN CR LOWER	05/21/93	2.3	MG/L
C9305-101624 NITRATE PLUS NITRITE AS N	INDIAN CR LOWER	05/21/93	0.02	MG/L
C9305-101624 ORTHO-PHOSPHORUS	INDIAN CR LOWER	05/21/93	0.025	MG/L
C9305-101624 LEAD	INDIAN CR LOWER	05/21/93	0.01	MG/L
C9305-101624 PH IN WATER	INDIAN CR LOWER	05/21/93	7.55	UNITS
C9305-101624 SILICA IN WATER BY ICP	INDIAN CR LOWER	05/21/93	14.7	MG/L
C9305-101624 SULFATE IN WATER	INDIAN CR LOWER	05/21/93	24.6	MG/L
C9305-101624 SPECIFIC CONDUCTANCE	INDIAN CR LOWER	05/21/93	127	UMHOS
C9305-101624 ZINC	INDIAN CR LOWER	05/21/93	0.51	MG/L
C9305-101625 ALKALINITY IN WATER	INDIAN CR UPPER		14.4	MG/L
C9305-101625 ARSENIC	INDIAN CR UPPER		0.085	MG/L
C9305-101625 CALCIUM	INDIAN CR UPPER		16.9	MG/L
C9305-101625 CADMIUM	INDIAN CR UPPER		0.008	MG/L
C9305-101625 CHLORIDE IN WATER	INDIAN CR UPPER		< 1.0	MG/L
C9305-101625 COPPER	INDIAN CR UPPER		< 0.01	MG/L
C9305-101625 FLUORIDE IN WATER	INDIAN CR UPPER		< 0.10	MG/L
C9305-101625 IRON	INDIAN CR UPPER		0.6	MG/L
C9305-101625 HARDNESS GRAINS PER GALLON	INDIAN CR UPPER		3.0	G/PG

APPROVED BY: DLB

\*\*FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-2642

testname	sampleid	date	reported	units
C9305-101625 TOTAL HARDNESS AS CaCO <sub>3</sub>	INDIAN CR UPPER		51.7	MG/L
C9305-101625 BICARBONATE	INDIAN CR UPPER		17	MG/L
C9305-101625 POTASSIUM	INDIAN CR UPPER		0.5	MG/L
C9305-101625 MAGNESIUM	INDIAN CR UPPER		2.3	MG/L
C9305-101625 MANGANESE	INDIAN CR UPPER		0.115	MG/L
C9305-101625 SODIUM	INDIAN CR UPPER		2.1	MG/L
C9305-101625 NITRATE PLUS NITRITE AS N	INDIAN CR UPPER		0.05	MG/L
C9305-101625 ORTHO-PHOSPHORUS	INDIAN CR UPPER		0.031	MG/L
C9305-101625 LEAD	INDIAN CR UPPER		0.016	MG/L
C9305-101625 PH IN WATER	INDIAN CR UPPER		7.4	UNITS
C9305-101625 SILICA IN WATER BY ICP	INDIAN CR UPPER		14.3	MG/L
C9305-101625 SULFATE IN WATER	INDIAN CR UPPER		26.1	MG/L
C9305-101625 SPECIFIC CONDUCTANCE	INDIAN CR UPPER		100	UMHOS
C9305-101625 ZINC	INDIAN CR UPPER		0.822	MG/L
C9305-101626 ALKALINITY IN WATER	WEASEL CR. UPPER		31.6	MG/L
C9305-101626 ARSENIC	WEASEL CR. UPPER		0.034	MG/L
C9305-101626 CALCIUM	WEASEL CR. UPPER		23	MG/L
C9305-101626 CADMIUM	WEASEL CR. UPPER		0.002	MG/L
C9305-101626 CHLORIDE IN WATER	WEASEL CR. UPPER		1.1	MG/L
C9305-101626 COPPER	WEASEL CR. UPPER		< 0.01	MG/L
C9305-101626 FLUORIDE IN WATER	WEASEL CR. UPPER		< 0.10	MG/L
C9305-101626 IRON	WEASEL CR. UPPER		1.24	MG/L
C9305-101626 HARDNESS GRAINS PER GALLON	WEASEL CR. UPPER		4.1	G/PG
C9305-101626 TOTAL HARDNESS AS CaCO <sub>3</sub>	WEASEL CR. UPPER		70.6	MG/L
C9305-101626 POTASSIUM	WEASEL CR. UPPER		1.5	MG/L
C9305-101626 MAGNESIUM	WEASEL CR. UPPER		3.2	MG/L
C9305-101626 MANGANESE	WEASEL CR. UPPER		0.142	MG/L
C9305-101626 SODIUM	WEASEL CR. UPPER		3.8	MG/L
C9305-101626 NITRATE PLUS NITRITE AS N	WEASEL CR. UPPER		0.94	MG/L
C9305-101626 ORTHO-PHOSPHORUS	WEASEL CR. UPPER		0.079	MG/L
C9305-101626 LEAD	WEASEL CR. UPPER		0.034	MG/L
C9305-101626 PH IN WATER	WEASEL CR. UPPER		7.68	UNITS
C9305-101626 SILICA IN WATER BY ICP	WEASEL CR. UPPER		21.9	MG/L
C9305-101626 SULFATE IN WATER	WEASEL CR. UPPER		35	MG/L
C9305-101626 SPECIFIC CONDUCTANCE	WEASEL CR. UPPER		166	UMHOS
C9305-101626 ZINC	WEASEL CR. UPPER		0.345	MG/L

F

APPROVED BY:

DLB

\*\*FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-2642

LAB ID	SAMPLE ID	Cr	Crc	Crq	NI	Nic	Niq	Cu	Cuc	Cuq	Zn	Znc	Znq	As	Asc	Asq	Ag	Agc	Agq
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## OHIO MINE

### DISSOLVED METALS: (ppb)

92Q1165 JOHS10L

-1.24 U 0.14 U 6.01 B 27.99 -0.57 U -1.01 U

### TOTAL RECOVERABLE METALS: (ppb)

92Q1166 JOHS10L

0.00 U 0.00 U 0.00 U 6.02 B 1.42 B 0.00 U

## FOREST ROSE MINE

### DISSOLVED METALS: (ppb)

92Q1055 DFRS10L

-1.62 U 0.60 U -0.55 U 25.86 -0.33 U -1.15 U

92Q1056 DFRS20L

-1.50 U 2.05 U 0.79 U 33.03 -0.37 U -1.14 U

92Q1057 DFRS30L

-1.66 U 1.12 U -0.32 U 1.25 U -0.07 U -1.14 U

## WASA MINE

### DISSOLVED METALS: (ppb)

92Q1058 DWSS10L

-1.61 U 10.57 B 12.21 B 175.64 -0.19 U -1.15 U

92Q1059 DWSS20L

-1.63 U 31.37 B 205.70 1353.93 4.12 B -1.15 U

92Q1060 DWSS30L

-1.41 U 5.56 B 0.50 U 630.10 0.52 U -0.97 U

### TOTAL RECOVERABLE METALS: (ppb)

92Q1061 DWSS20L

0.00 U 28.57 B 395.77 1469.00 34.59 0.00 U

### TOTAL METALS: (ppm)

92S1063 DWSD30H

13.01 B 59.73 B 1179.95 \* 2365.55 N\* 263.70 \* 0.00 U \*

92S1064 DWSD20H

12.99 B 59.13 B 2565.33 \* 5929.72 N\* 345.70 \* 0.00 U \*

92S1065 DWSD10H

2.08 B 3.34 B 4535.49 \* 512.14 N\* 424.19 \* 0.00 U \*

## BANNER MINE

Two surface water samples collected at site in 1993. Results not available yet.



LAB ID	SAMPLE ID	Cd	Cdc Cdq	Ba	Bac Baq	Pb	Pbc Pbq	Hg	Hgc Hgq
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## OHIO MINE

### DISSOLVED METALS: (ppb)

92Q1165 JOHS10L

-0.59 U 59.63 B -0.70 U

### TOTAL RECOVERABLE METALS: (ppb)

92Q1166 JOHS10L

0.00 U 60.72 B 0.00 U 0.12 B

## FOREST ROSE MINE

### DISSOLVED METALS: (ppb)

92Q1055 DFRS10L

-0.73 U 7.88 B -1.10 U

92Q1056 DFRS20L

-0.47 U 16.18 B -0.81 U

92Q1057 DFRS30L

-0.90 U 28.57 B -1.07 U

## WASA MINE

### DISSOLVED METALS: (ppb)

92Q1058 DWSS10L

1.10 U 23.11 B -0.90 U

92Q1059 DWSS20L

21.39 0.77 U -1.03 U

92Q1060 DWSS30L

4.20 B 7.98 B -0.81 U

### TOTAL RECOVERABLE METALS: (ppb)

92Q1061 DWSS20L

20.54 0.00 U 2.37 B 0.13 B

### TOTAL METALS: (ppm)

92S1063 DWSD30H

33.79 67.38 B N\* 83.05 1.23

92S1064 DWSD20H

81.56 48.09 B N\* 53.45 1.57

92S1065 DWSD10H

15.50 19.02 B N\* 45.34 2.43

## BANNER MINE

Two surface water sample



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

OHIO  
PA NO. 04-009



# **AIMSS SCORESHEET**

SITE NAME:

OHIO

PA NUMBER:

04-009

LINE NO.		GROUNDWATER PATHWAY	
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT	20
3B		GW DEPTH	20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
6		WELLS - 1 MI. x 2.5	0.0
7	GW - TARGETS	WELLS - 1 TO 4 MI	37
8		NEAREST WELL	0
9		TARGETS SCORE	LINES 6 + 7 + 8
10		GROUNDWATER SCORE	LINES 4 x 5 x 9

130595

		SURFACE WATER PATHWAY	
11		OBSERVED RELEASE	300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES	0
13A		CONTAINMENT	20
13B		DISTANCE TO SW	20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
16		DRINKING WATER POP'N	0
17		IMPACTED DRAINAGE	1
18	SW - TARGETS	WETLANDS	10
19		FISHERY	0
20		RECREATION	5
21		IRRIGATION/STOCK	2
22		T & E SPECIES HABITAT	0
23		TARGETS SCORE	SUM LINES 16 - 22
24		SURFACE WATER SCORE	LINES 14 x 15 x 23

133144

		AIR PATHWAY	
25		OBSERVED RELEASE	0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT	15
26B		DISTANCE TO POPULATION	5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B
27		LIKELIHOOD SCORE	LINES 25 + 26C
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
29		POPULATION - 4 MILES	10
30	AIR - TARGETS	NEAREST RESIDENCE	0
31		WETLANDS	0
32		PARKS / WILDERNESS	0
33		T & E SPECIES HABITAT	0
34		TARGETS SCORE	SUM LINES 29 - 33
35		AIR PATHWAY SCORE	LINES 27 x 28 x 34

80

		DIRECT CONTACT PATHWAY	
36		OBSERVED EXPOSURE	50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY	20
37B		DISTANCE TO POPULATION	5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B
38		LIKELIHOOD SCORE	LINES 36 + 37C
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)
40	DIRECT CONTACT	POPULATION - 1 MILE	0
41	TARGETS	NEAREST RESIDENCE	0
42		RECREATIONAL USE	5
43		TARGETS SCORE	SUM LINES 40 - 42
44		DIRECT CONTACT SCORE	LINES 38 x 39 x 43

66

45 TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE  
(LINES 10 + 24 + 35 + 44) / 100,000

2.64

LINE NO.	SITE NAME:		OHIO
	PA NUMBER:		04-009
	<b>SITE SAFETY</b>		
1	THREAT	ACCESSIBILITY	20
2		OPEN SHAFTS 100 EA.	100
3		OPEN ADITS 50 EA.	50
4	HAZARDS	UNSTAB. HIWALLS / PITS 75 EA.	0
5		HAZ. STRUCTURES 40 EA.	320
6		EXPLOSIVES	0
7		HAZ. MATERIALS	0
8		HAZARDS SCORE SUM LINES 2 - 7	470
9		POPULATION - 1 MILE	0
10	TARGETS	NEAREST RESIDENCE	0
11		RECREATIONAL USE	5
12		TARGETS SCORE SUM LINES 9 - 11	5
13		<b>SITE SAFETY SCORE (LINES 1 x 8 x 12) / 1,000</b>	<b>47.00</b>





04-009, #19: Mill



04-009, #20: Shaft and WR-1



04-009, #21: TP-1 and TP-2



04-009, #22: WR-2



MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: KEATING TAILINGS PA#: 04-121

Date: September 3, 1993 Time: 1200-1645

Field Team Leader: Bullock, Pioneer

Sampling Personnel: M. Babits, S. Babits,  
Flammang; Pioneer  
Pierson; TD&H

Visitors: None

Weather/Seasonality Observations: Approx. 80°F; sunny; slight breeze; cool, wet, spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #23: TP-2; #24: TP-1.  
Video Tape No. 6

General Comments/Observations (not covered specifically in attached Inventory Forms): N/A

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Improve diversion, cover and revegetate tailings. Additional study concerning potential groundwater impacts may be necessary.





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): KEATING TAILINGS PA#: 04-121

Legal Description: T 5N ; R 1E ; Sec. 18 , SE1/4 SE1/4 1/4

County: BROADWATER Mining District: RADERSBURG

Latitude: N 46° 11' 02" Longitude: W 111° 39' 34"

Primary Drainage Basin and Code: Crow Creek/10030101

Secondary Drainage Basin: Keating Gulch

USGS Quadrangle map name(s): Radersburg

Mine Type/Commodities: Tailings/Gold, Copper

Activity Status: Active ☐ , Inactive/Exploration ☐ , Abandoned ☒ .

Ownership status: Known YX N ; private/public? Private/Public

Owner (Include address and phone when available): Peter Antonoli, Northmont Resource and Exploration Co., P.O. Box 791, Butte, MT 59701; BLM

Relationship to other mines/sites in the area/district: Related to the Keating Mine on hillside above although no tailings disposal has occurred recently.

Regulatory Status (Activity by other agencies)? Hardrock permits? Past Reclamation Activities? N/A

General site features: Elevation 4600' , Slope 5° , Aspect Southeast

Land use: Mining ☒ , Recreational ☐ , Residential ☐ , Urban ☐ , Agricultural ☒ , Other(Specify)

Area of disturbed/unvegetated lands? 10 acres.

Dimensions:

Predominant vegetation types: Juniper, sage, rabbit brush, blue bunch wheat grass, Limber pine

Access: roads - good ☒ , poor ☐ , 4wd ☐ , trail ☐ .

Other logistical considerations (proximity to other sites). Along Keating Gulch Road; site is located in close proximity to the Ohio Mine/Mill.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
MEMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Site lies on north side and in floodplain  
of intermittent Keating Gulch. In spite of a very wet summer, the  
gulch was dry at time of sampling. Water in Keating Gulch would  
flow east through site. Keating Gulch empties into Crow Creek 2 to  
3 miles east of site. Site is underlain by porphyritic andesites.

Mining/milling history, ore type/tenor, host rock, gangue:  
Currently, the mill is abandoned, and the mine is active with CN-  
leach pads. Keating vein was discovered in 1866. In 1870, a 15-  
stamp amalgamating mill was built and the property operated  
continuously until 1877 when oxidized ores were exhausted. Small  
blast furnace was built in 1878 to smelter sulfide ores, but was  
soon abandoned. There was almost continuous production at Keating  
until 1948. Ore was found as auriferous pyrite in quartz  
accompanied by minor amounts of calcite. Some veins carry  
accessory copper sulfides (chalcopyrite). Vein is persistent  
fracture filling and replacement in altered porphyritic andesite.  
Production records indicate recovered metal content of the ore  
average 0.38 ounces of gold per ton and 0.25% copper. Peak output  
was in 1938 when 44,500 tons of ore mined and concentrated.  
Literature also reported to have 10-stamp mill instead of 15 for  
concentration.

#### Mine Operation?

Shafts - Yes ☐, No ☒, # , Comment   
Adits - Yes ☐, No ☒, # , Comment   
Pits - Yes ☐, No ☒, # , Comment   
Placers - Yes ☐, No ☒, # , Comment   
Other - Yes ☐, No ☒, # , Comment

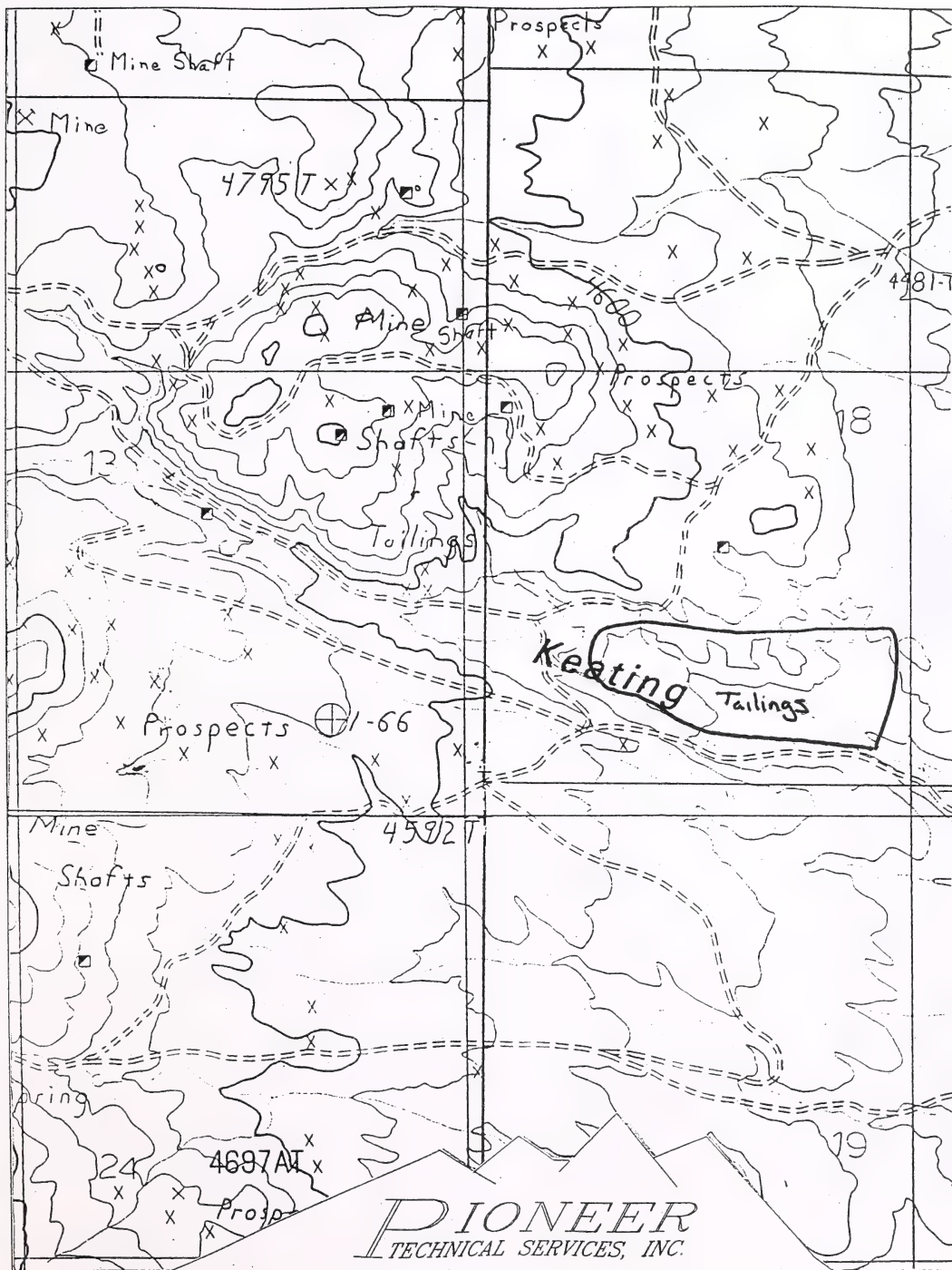
Mill Operation? Yes ☒, No ☐. If yes answer the next three  
questions:

Period(s) of Operation: 1870-1878

Origin of Ore Milled - Custom Mill ☐ Dedicated Mill ☐; Number and  
names of mines that supplied mill feed: Keating; Ohio-Keating

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting?  
Amalgamating mill, possibly gravity or floatation later





KEATINGS TAILINGS, P.A. NO. 04-121

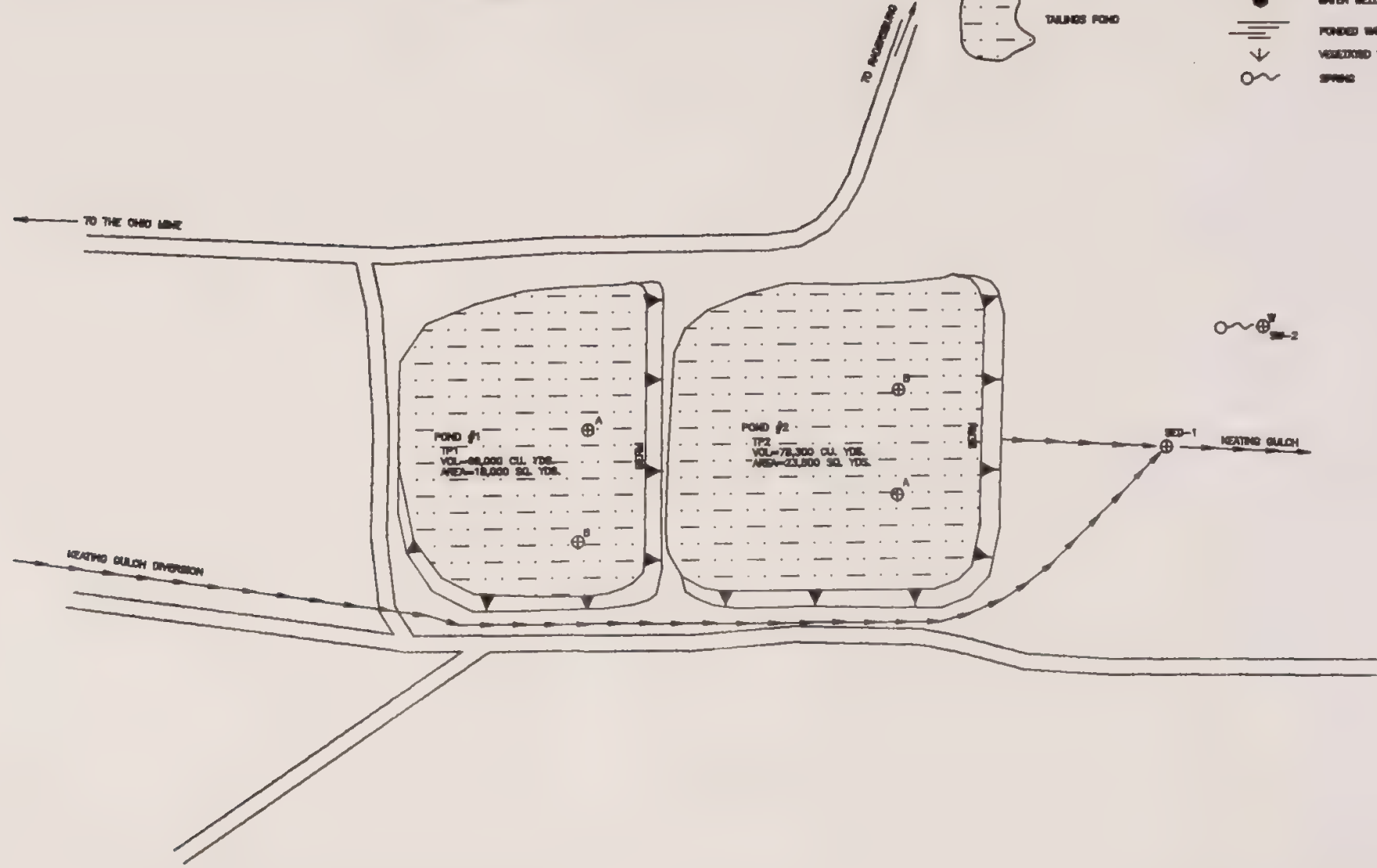
T05N, R01E, SECTION 18

SCALE: 1" = 1000'





KEATING'S MINE AREA  
(ACTIVE)



SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CULVERT		OPEN ADIT
	LIGHT (LIGHT POLE)		COLLAPSED ADIT
	UTILITY POLE		OPEN SHAFT
	DISCOURAGED TREE		COLLAPSED SHAFT
	CONSPICUOUS TREE		EXCAVATION
	WOOD FENCE		WHITE ROCK DUMP
	WIRE FENCE		COLLAPSED TIMBER
	BUILDING		RAILS
	BARBER POST		SOIL SAMPLE
	GATE		XRF SAMPLE
	EDGE OF ASPHALT		WATER SAMPLE
	EDGE OF GRAVEL		GROUND AND SURFACE DRAINAGE
	SLOPE DIRECTION		WATER WELL
	TAILINGS POND		PONDED WATER
			VEGETATED WET LANDS
			SPRING

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY

KEATING TAILINGS PA# 04-121  
RADARSBURG BROADWATER COUNTY

SHEET NO.

PIONEER  
ENGINEERS & SURVEYORS

TDS&H

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
SPOKANE

DRAWN TNC DATE 30 NOV 93  
DESIGNED TPR JOB NO. 03-17  
APPROVED TDR F.B. NO.



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runon/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): 30% fine to medium sand; 70% silty clay to clay

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Upper pond is 12' deep with interbeds of sand and clay with narrow reduced zone at 9-12'. Lower pond is approx. 7' deep with no distinct reduced zone and also interbedded.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Lower clay zones are moist. Some ponding of precipitation is present on the surface.

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Drainage is routed around tailings. Slight breaching of the berm at the end of TP-2.

Comments on potential for mitigation: Amend and revegetate with more efficient runon/runoff control.





# **SOURCE INVENTORY FORM**

SAMPLERS: Bullock, Pierson

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	PH SU (D/S)*	RADIO-ACTIVITY (MR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
TP-1A-A	TAIL	66,000	Upper pond east center; 0-2', tan/orange sand	Impoundment	<3.5 (D)	0.04	04-121-TP-1	09/03/93 1600	T-Metals, ABA
TP-1A-B	TAIL		Upper pond east center; 4-5', gray clay	Impoundment	<3.5 (D)	0.045			
TP-1A-C	TAIL		Upper pond east center; 5-9', brown silty sand	Impoundment	<3.5 (D)	0.05			
TP-1A-D	TAIL		Upper pond east center; 9-13', gray/brown clay	Impoundment	<3.5 (D)	0.05			
TP-1B-A	TAIL		Upper pond southeast end; 0-2', light brown silty sand	Impoundment	<3.5 (D)	0.04			
TP-1B-B	TAIL		Upper pond southeast end; 2-7', brown silty sand	Impoundment	<3.5 (D)	0.05			
TP-1B-C	TAIL		Upper pond southeast end; 7-12', gray moist silty sand	Impoundment	5.6 (D)	0.04			
TP-2A-A	TAIL	78,300	South eastern end; 0-2', orange/brown clay	Breached Impoundment	<3.5 (D)	0.03	04-121-TP-2	09/03/93 1600	T-Metals, ABA
TP-2A-B	TAIL		South eastern end; 2.5-7', orange/brown clay	Breached Impoundment	4.0 (D)	0.04			
TP-2A-C	TAIL		South eastern end; 7-8', orange/black clay	Breached Impoundment	6.0 (D)	0.05			
TP-2B-A	TAIL		East central end; 0-2', tan sand and clay	Breached Impoundment	6.8 (D)	0.04			
TP-2B-B	TAIL		East central end; 2-4', interbeds of orange sand/clay	Breached Impoundment	5.9 (D)	0.03			
SS-1	SOIL	N/A	Background soil collected 850' above mill building at Ohio	N/A	6.0 (D)	0.06	04-009-SS-1	09/03/93	T-Metals

\*D-Direct reading(Kelway Meter); S-Saturated Paste(Orion Meter)

Comments or deviations from SOPs: 04-121-TP-1 is a composite of TP-1A-A through -1A-D, and TP-1B-A, through -1B-C. 04-121-TP-2 is a composite of TP-2A-A through -2A-C, and TP-2B-A and -2B-B.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes     , No X, Number:      Identification:                     

Filled shafts: Yes     , No X, Number:      Identification:                     

Seeps/Springs: Yes X, No     , Number: 1 Identification: Near  
northeast corner of toe of TP-2.

Groundwater wells within 4 miles?: Yes X, No     ;  
Number of well logs: 27

Distance to nearest well used for drinking? Approx. 1.5 miles

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite     , Probable     , Possible X, Unlikely     .

Precipitation may pick up metals as it migrates through tailings and caused localized groundwater contamination.

Other observations/notes: N/A

**SAMPLERS:** S. Babits, M. Babits

[illegible]

FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes ☐, No ☒, Name(s): \_\_\_\_\_

Dry streambeds: Yes ☒, No ☐, Name(s): Keating Gulch dry both up and down gradient of this site.

Other surface water: Yes ☒, No ☐, Name(s)/Description: Precipitation is ponded on lower tailings pond.

Waste materials within any floodplain: Yes ☒, No ☐ Source ID(s): TP-1 and TP-2

Approximate Flood frequency? ☐ 1 yr, ☒ 10 yr, ☐ 100 yr

Estimated seasonal flow of stream(s) (cfs)? 0 during investigation

High Flow: 5-10 cfs, Average Flow: 20-50 gpm

Distance between waste source(s) and nearest surface water body (ft)? 10 to 20 feet

Surface water draining onto or through waste sources: Yes ☐, No ☒, Describe: \_\_\_\_\_

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Stock watering, irrigation, T&E - Bald Eagle, recreation, and fishery on the Missouri.

Observed erosional/sedimentation/stream turbidity problems? Yes ☐, No ☒, Distance downstream (ft)? \_\_\_\_\_ Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present):  
None observed during this investigation.



**SAMPLERS:** M. Babits, S. Babits

FLOW: Estimated (E) or Measured (M)?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): The downgradient surface water sample for the Ohio Mine serves as upgradient for the Keating Tailings site.





**SAMPLERS:** Bullock, Pierson

### Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe: Active mine within 1/4 mile.

Population within 1 mile: 1-10\_\_\_\_; 10-30\_\_\_\_; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments None

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: Off-  
road vehicle tracks

Accessibility - Fences, warning signs, closed roads? "No trespassing"  
signs are posted.

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment_____
Wilderness Area -	Yes____, No <u>X</u> , Comment_____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment_____
Bat Habitat -	Yes____, No <u>X</u> , Comment_____

Primary Drainage\_\_\_\_; Secondary Drainage X; No Information\_\_\_\_:

Riparian Habitat Quality -	High____, Medium____, Low <u>Not Rated</u>
Wetlands Frontage -	High____, Medium____, Low <u>Not Rated</u>
Fisheries Habitat and Species Classification -	<u>Not Rated</u>
Sport Fishery Classification -	<u>Not Rated</u>

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Hazardous structures: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_,  
types and locations:\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes X, No\_\_\_\_,  
Number 1, types and locations: Impoundment on lower pond is failing.  
\_\_\_\_\_  
\_\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain:\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Bibliography

MBMG, Well Log Database, September 8, 1993.

MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.

MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Keating Tailings, Prepared by Northern Engineering and Testing, June 15, 1988.

USBM, Mines and Mineral Deposits (Except Fuels), Broadwater County, Montana, Information Circular 7592, Written by Glenn C. Reed, April 1951.

USGS, Mining Districts of the Dillon Quadrangle, Montana and Adjacent Areas, Bulletin 574, Written by Alexander N. Winchell, 1914.

USGS, Topographic Map, Radersburg, Montana, 7 1/2 minute Quadrangle, 1986.



LABORATORY ANALYTICAL DATA

KEATING TAILINGS  
PA NO. 04-121





Keating Tailings PA# 04-121  
AMRB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BULLOCK  
INVESTIGATION DATE: 09/03/93

SOLID MATRIX ANALYSES

Metals in soils  
Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
04-121-SE-1	26.7 J	50 J	1 U	13.1	6.48	52.5	21500 J	0.026 U	455	8.18 J	40.6 J	5.09 UJ	108 J	NR
04-009-SE-2	50.6 J	56.4 J	1 U	12.5	4.9	75.9	35300 J	0.070 J	295	7.85 J	29.4 J	5.76 UJ	85.5 J	NR
04-121-TP-1	143 J	128 J	1 U	9.52	11.6	378	43200 J	0.184 J	235	5.23 J	57.3 J	5.91 UJ	251 J	NR
04-121-TP-2	336 J	279 J	2	11.2	8.17	486	55200 J	0.76 J	3040	11.1 J	684 J	7.74 UJ	2640 J	NR
BACKGROUND	6.11 J	214 J	1 U	8.92	6.14	22.6	19200 J	0.106 J	819	7.83 J	25.2 J	6.96 UJ	79.6 J	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR		NEUTRAL POTENT.		SULFUR POTENT.		ORGANIC SULFUR		PYRITIC SULFUR		SULFUR ACID BASE POTENT.	
	%	u/1000	%	u/1000	%	u/1000	%	u/1000	%	u/1000	%	u/1000
04-121-TP-1	1.81	56.5	-2.0	-58.	1.29	-58.	0.02	15.6	0.5	0.08	-17.7	-15.7
04-121-TP-1	1.8	56.2	-1.9	-58.	1.28	-58.	0.08	13.7	0.44	0.08	-15.7	-15.7
04-121-TP-2	0.93	29.1	7.93	-21.	0.85	-21.	0.05	0.94	0.03	0.05	6.99	6.99

WATER MATRIX ANALYSES

Metals in Water  
Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn	HARDNESS CALC. (mg CaCO <sub>3</sub> /L)
04-121-SW-1	3.85	8.6	4.59 U	5 U	9.37 U	2.33 U	894	0.12 U	707	10.9 U	0.72 U	31.7 U	13.6	1050
04-009-SW-2	1.18 U	33.4	4.59 U	5 U	6.24 U	2.33 U	85.9	0.12 U	3.76 U	10.9 U	0.93	31.7 U	9.33	281

Wet Chemistry  
Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO <sub>3</sub> /NO <sub>2</sub> -N	CYANIDE
04-121-SW-1	1604	18	981	< 0.05	< 0.005
04-009-SW-2	366	6.0	135	< 0.05	NR

LEGEND

SE1 - Downgradient in Keating Gulch.

SE2 - 400' downgradient of berm on tailing pond 2 of the Ohio Mine. This serves as the upgradient sample for 04-121.

TP1 - Composite of subsamples TP1A-A, B, C, and 1B-A, B, C.

TP2 - Composite of subsamples TP2A-A, B, C, and 2B-A, B.

BACKGROUND - From the Ohio Mine (04-009-SS-1).

TP1DUP - Duplicate of the sample 04-121-TP1.

SW1 - Spring at the toe of tailings pond 2.

SW2 - Same as sample SE2.

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested



**XRF ANALYSIS RESULTS**

**KEATING TAILINGS  
PA NO. 04-121**



Mine Name: Keating Tailings PA# 04-121

XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	Cr:HI	K	Ca	Ti	Cr:LO	Mn	Fe	Co	Cu	Zn	As	Sr
04-121-SS-1	12119.7	12831	1896.99	740.721 *	26822.8				62.3317 *	107.875 *	41.5883 *	480.394
04-121-TP1A-A	61289.1	11225.2	1847.87	349.743 *	49457.1				316.209	176.968	189.221	483.454
04-121-TP1A-B	66524.8	4147.89	1973.58	780.649 *	18898.9				703.286	193.841	149.821	297.759
04-121-TP1A-C	66713.1	8542.33	1760	335.016 *	29965.2				135.3 *	146.192	42.9173 *	447.9
04-121-TP1A-D	64815.7	12834.4	2175.35		37495.2				314.759	201.553	104.757 *	538.921
04-121-TP1B-A	47968.2	13693.3	1235.76	494.138 *	35828.1				276.443	145.813 *	167.89	285.3
04-121-TP1B-B	71418.6	8886.95	1995.87	555.636 *	38957.7				111.834 *	193.632	52.642 *	521.12
04-121-TP1B-C	45683.7	11213.9	1617.9	405.5 *	31137.8				314.455	230.07	128.214	430.955
04-121-TP2A-A	45958.3	7763.21	1625.62	551.657 *	38773.7				239.117	401.34	143.4	354.246
04-121-TP2A-B	75844.5	7335.83	1677.81	709.304 *	46130.3				205.004 *	150.45 *	79.4345 *	427.772
04-121-TP2A-C	63490.7	18747.8	1794.87	604.309 *	49488.9				173.296 *	230.353	82.7695 *	519.377
04-121-TP2B-A	57155.9	11839.1	1630.87	1148.31	38417.4				219.861	513.325	156.014	391.427
04-121-TP2B-B	59826.6	7564.85	1653.35	691.766 *	39600.9				198.826	208.212	87.823 *	481.669
04-121-TP-1-COMP	67086.9	10168.7	1820.18	526.113 *	32440.1				348.499	124.896 *	98.4559 *	433.553
04-121-TP-2-COMP	46619	7631.97	1191.56	742.475 *	35099.8				156.955 *	359.547	103.281 *	369.045
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
04-121-SS-1	182.433				82.2134			371.803		25.637 *	30.3107	
04-121-TP1A-A	140.068		9.66096 *		182.598			1308.59			6.00842 *	
04-121-TP1A-B	132.859		4.51985 *		247.313			1292.27			6.21821 *	
04-121-TP1A-C	132.128				256.171			1855.74				
04-121-TP1A-D	148.541				216.398			1565.02		12.0319 *	7.04889 *	
04-121-TP1B-A	133.809		10.8508 *	42.2465 *	253.663			824.111			13.5782 *	
04-121-TP1B-B	136.776				295.782			2059.2		12.8285 *		
04-121-TP1B-C	124.665		6.43734 *	21.7626 *	217.819			1140.07			7.10481 *	
04-121-TP2A-A	122.818			113.392	202.542			1047.62				
04-121-TP2A-B	131.498			33.513 *	297.957			1725.24				
04-121-TP2A-C	138.006			33.6988 *	236.219			1414.86			8.02646 *	
04-121-TP2B-A	133.313		4.84526 *	145.845	215.291	196.931 *		1110.87				
04-121-TP2B-B	120.887		5.80125 *	54.7374 *	251.609			1378.17			8.52324 *	
04-121-TP-1-COMP	134.832				236.662			1755.77				
04-121-TP-2-COMP	99.5599		8.5554 *	83.3798	203.335			981.512				

\* - Estimated Quantity

\$ - Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

KEATING TAILINGS  
PA NO. 04-121



# AIMSS SCORESHEET

SITE NAME:

KEATING TAILINGS

PA NUMBER:

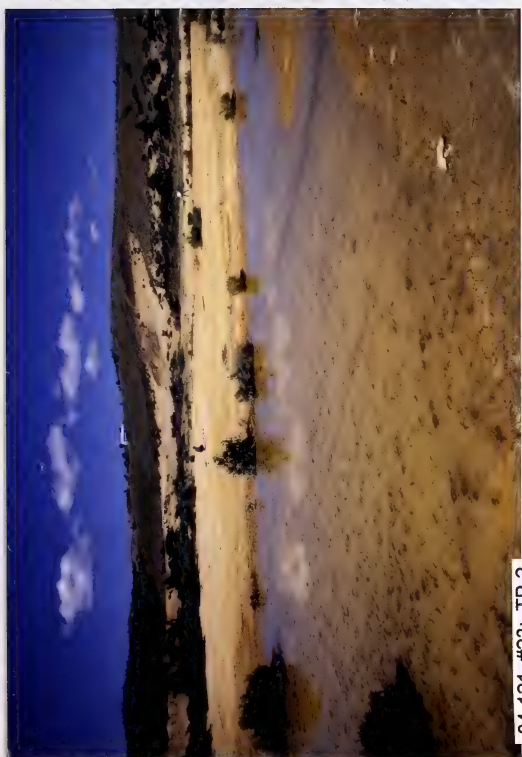
04-121

LINE NO.		GROUNDWATER PATHWAY	PA NUMBER:	04-121
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	35.212
6		WELLS - 1 MI. x 2.5		0.0
7	GW - TARGETS	WELLS - 1 TO 4 MI		27
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	27.0
10		GROUNDWATER SCORE	LINES 4 x 5 x 9	380290
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		0
12		EXCEEDENCES		0
13A	SW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	400
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	39.454
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		0
18		WETLANDS		0
19	SW - TARGETS	FISHERY		0
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	7
24		SURFACE WATER SCORE	LINES 14 x 15 x 23	110471
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		20
26B		DISTANCE TO POPULATION		5
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	100
27		LIKELIHOOD SCORE	LINES 25 + 26C	100
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.315
29		POPULATION - 4 MILES		30
30		NEAREST RESIDENCE		0
31	AIR - TARGETS	WETLANDS		0
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	30
35		AIR PATHWAY SCORE	LINES 27 x 28 x 34	3945
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		10
37B		DISTANCE TO POPULATION		5
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	50
38		LIKELIHOOD SCORE	LINES 36 + 37C	100
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	1.174
40		POPULATION - 1 MILE		0
41	DIRECT CONTACT TARGETS	NEAREST RESIDENCE		0
42		RECREATIONAL USE		2
43		TARGETS SCORE	SUM LINES 40 - 42	2
44		DIRECT CONTACT SCORE	LINES 38 x 39 x 43	235
45	TOTAL SITE HUMAN & ENVIRONMENTAL HAZARD SCORE (LINES 10 + 24 + 35 + 44) / 100,000			4.95

		SITE NAME:		KEATING TAILINGS
		PA NUMBER:		04-121
LINE NO.	<u>SITE SAFETY</u>			
1	THREAT	ACCESSIBILITY		10
2	HAZARDS	OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4		UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	0
9	TARGETS	POPULATION - 1 MILE		0
10		NEAREST RESIDENCE		0
11		RECREATIONAL USE		2
12		TARGETS SCORE	SUM LINES 9 - 11	2
13	SITE SAFETY SCORE		(LINES 1 x 8 x 12) / 1,000	0.00



04-121, #24: TP-1



04-121, #23: TP-2









MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: EAST PACIFIC PA#: 04-008

Date: July 27 and 28, 1993 Time: 1400 / 0800

Field Team Leader: Babits, Pioneer

Sampling Personnel: Flammang, Pioneer  
Lasher, Pioneer

Visitors: None

Weather/Seasonality Observations: July 27: Partly cloudy; warm (60°); July 28: Sunny; warm (70°F); cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #20, #21: WR-1, WR-2.  
Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms): N/A

Other Hazardous Materials/Substances Present: Nine barrels in upper buildings marked sodium antimonate appear to contain concentrate. Also, one building up near the top contains asbestos.

General Comments on Potential Remedial Alternatives: Most of the waste rock dumps appear to be too coarse and steep to allow vegetation to grow. Ponds should be capped or removed because downstream surface water has levels of metals elevated above background and above levels in adit discharge.



## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): EAST PACIFIC PA#: 04-008

Legal Description: T 8N ; R 1W ; Sec. 26 , NW1/4 1/4 1/4  
Sec. 27 , NE1/4 1/4 1/4

County: BROADWATER Mining District: WINSTON

Latitude: N 46° 25.1' Longitude: W 111° 42.2'

Primary Drainage Basin and Code: Weasel Creek/10030101  
Secondary Drainage Basin: Spring Gulch

USGS Quadrangle map name(s): Winston

Mine Type/Commodities: Hardrock/Gold, Silver, Lead, Zinc, Copper

Activity Status: Active    , Inactive/Exploration X , Abandoned    .

Ownership status: Known YX N ; private/public? Private/Public  
Owner, Agent, or Contact (Include address and phone when available): George Neill  
(Trustee), Northwestern Union Trust Company, P.O. Box 597, Helena,  
MT 59601; Helena National Forest.

Relationship to other mines/sites in the area/district: Unknown

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 5800'-6560' , Slope 30° ,  
Aspect East

Land use: Mining X , Recreational    , Residential    , Urban    ,  
Agricultural    , Other (Specify)   

Area of disturbed/unvegetated lands? 7 acres.  
Dimensions:   

Predominant vegetation types: Sage, grasses, wildflowers (lupine  
and roses) on hillside; Douglas fir, raspberries on dumps.

Access: roads - good X , poor    , 4wd    , trail    .  
Other logistical considerations (proximity to other sites). Near  
Vosburg mine and Kleinschmidt Group; locked gates at base of site.

Well logs within 1 mile radius; water rights 15 mi downstream (Attach MBMG Well Log Printout(s): There are no well logs within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also note presence of radioactive minerals). The site lies on the north side of the perennial creek, Spring Gulch, which is a tributary to the perennial Weasel Creek. Spring Gulch enters Weasel Creek approx. 1/2 mile from the mine/mill. Country rock is predominantly dark gray porphyritic andesite.

Mining/milling history, ore type/tenor, host rock, gangue: Gold-bearing rock was first discovered in 1867; production began in early 1880's. A 50-ton concentrator was built in 1904. By 1952, the mine was inaccessible. Underground development at the mine is about 4 1/2 miles long. Mine was dewatered through pumping from portal near mill. Ore is in a vein strikes N78E, dips 75N. Principle ore minerals were argentiferous galena, auriferous pyrite, sphalerite, and small amounts of chalcopyrite and tetrahedrite in a gangue of quartz and carbonate minerals. Vein was a fissure filling in andesite.

Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 5, Comment 1 open; 2 caved; 2 partially caved; 2 discharge  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

Mill Operation? Yes X, No     . If yes answer the next three questions:

Period(s) of Operation: Early 1880's to approx. 1952

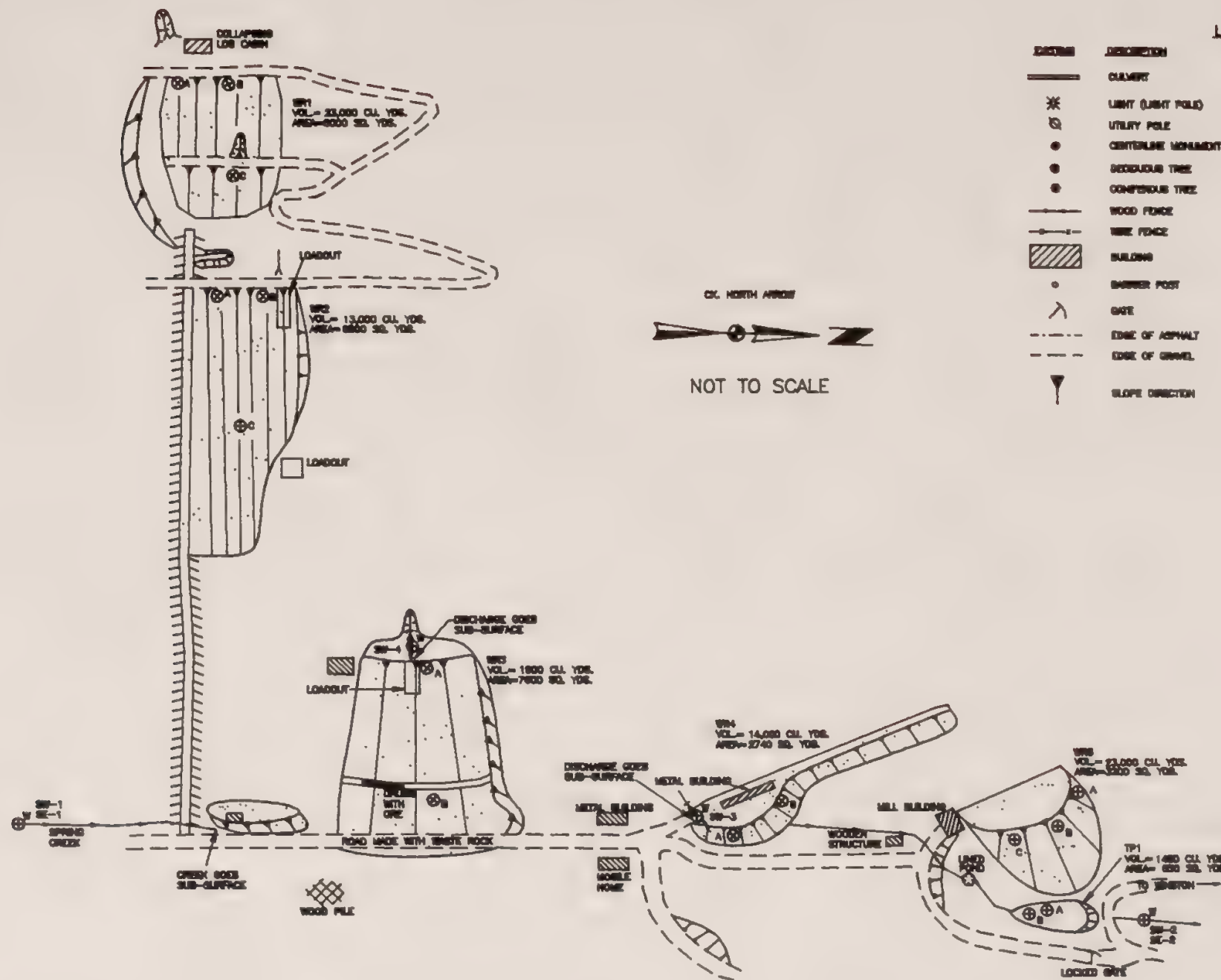
Origin of Ore Milled - Custom Mill      Dedicated Mill X; Number and names of mines that supplied mill feed: East Pacific

Process? Hg-amalgam, CN leach (vat, heap), floatation, smelting? 50-ton gravity concentrator; possible recent CN leach.









OK NORTH ARROW

NOT TO SCALE

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
—	CULVERT	—	OPEN ADIT
*	LIGHT (LIGHT POLE)	—	COLLAPSED ADIT
•	UTILITY POLE	—	OPEN SHAFT
•	CENTERLINE MONUMENT	—	COLLAPSED SHAFT
•	DECIDUOUS TREE	—	EDDINGTON
•	CONIFEROUS TREE	—	WHITE ROCK DUMP
—	WOOD FENCE	—	COLLAPSED TIMBERS
—	WIRE FENCE	—	PAIS
—	BUILDING	—	SOIL SAMPLE
•	BARBER POST	—	WPT SAMPLE
—	GATE	—	WATER SAMPLE
—	EDGE OF ASPHALT	—	GROUND AND SURFACE
—	EDGE OF GRAVEL	—	GRANITE
—	SLOPE DIRECTION	—	WATER WELL

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY  
EAST PACIFIC PA# 04-008  
WINSTON DISTRICT BROADWATER COUNTY

DATE 22 SEPT 83  
JOB NO. 83-17  
DRAWN JTP  
DESIGNED JTP  
APPROVED JTP  
THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS-BOZEMAN-KALISPELL  
MONTANA WASHINGTON



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff/runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
Fine sand, 0'-5'; fine clay, 5'-6'; coarse sand, 6'-9'.

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): 9' deep at deepest point.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Moist to saturated

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): Gravel berm with PVC pipe.

Comments on potential for mitigation: Reprocess; remove because of CN-, or revegetate.



# **SOURCE INVENTORY FORM**

SAMPLERS: Flammang, Lasher\*

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	PH SU (D/S)*	RADIO-ACTIVITY (MR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
WR-1A	WR	23,000	Approx. 50' down from south side of road and 75' west from collapsed adit	None	6.9 (D)	0.04	04-008-WR-1	07/28/93 1050	T-Metals, ABA
WR-1B	WR		North side of WR-1; 35' from top	None	6.7 (D)	0.05			
WR-1C	WR		Immediately below Adit #1B	None	6.8 (D)	0.06			
WR-2A	WR	13,000	Approx. 50' from north edge of WR-2 along dump that runs full length of slope	None	6.4 (D)	0.06			
WR-2B	WR		Approx. 30' from end of loadout on WR-2; north side	None	6.7 (D)	0.04			
WR-2C	WR		Approx. 50' northwest of lower loadout on WR-2	None	6.5 (D)	0.05			
WR-3A	WR	1,900	Approx. 50' north of loadout below Adit #3	None	5.9 (D)	0.04	04-008-WR-2	07/28/93 1055	T-Metals, ABA
WR-3B	WR		North of loadout approx. 100' from bottom	None	6.6 (D)	0.05			
WR-4A	WR	14,000	Approx. 20' from south side of loadout by Adit #4	None	6.4 (D)	0.05	04-008-WR-3	07/28/93 1100	T-Metals, ABA
WR-4B	WR		North of large loadout by Adit #4 and east of building and power poles; 3' from top	None	6.7 (D)	0.05			
WR-5A	WR	23,000	North end of WR-5 near top	None	6.6 (D)	0.05			
WR-5B	WR		South end of concentrator by electric pole	None	6.6 (D)	0.04			
WR-5C	WR		Northern most end of WR-5 off high peak	None	6.8 (D)	0.04			

\*D-Direct reading(Kelway Meter); S-Saturated Paste(Orion Meter)

**Comments or deviations from SOPs:** 04-008-WR-1 is composite of WR-1A through -1C, and WR-2A through -2C. 04-008-WR-2 is composite of WR-3A and -3B. 04-008-WR-3 is composite of WR-4A and -4B, and WR-5A through -5C.

\*Continued on next page



**SAMPLERS:** Flammang, Lasher

[illegible]

P - Direct reading (Kelvin Meter); B - Saturated Paste (Orion Meter)

Comments or deviations from SOPs: 04-008-TP-1 is composite of TP-1A-A through -1A-C, and TP-1B-A and -1B-B.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes X, No    , Number: 2 Identification: Adits #3 and #4

Filled shafts: Yes    , No X, Number:     Identification:    

Seeps/Springs: Yes X, No    , Number: 1 Identification: Possibly expression of Spring Creek

Groundwater wells within 4 miles?: Yes X, No    ;  
Number of well logs: 973

Distance to nearest well used for drinking? 100 feet east of TP-1

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite    , Probable    , Possible X, Unlikely    .

All pH's are good; however, metal content of dumps are high and water from Adits #3 and #4 and the creek flow through the waste rock dumps. Water may also flow through the tailings.

Other observations/notes: Water from Adit #3 is drained from adit by a pipe; water runs across WR-3 approx. 20' before disappearing into the dump. Adit #4 is drained via a buried pipe and disappears into WR-4.

**SAMPLERS: Babits**

[illegible]

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No     , Name(s): Unnamed tributary to Weasel Creek that was called Spring Gulch on previous investigations

Dry streambeds: Yes X, No     , Name(s): Stream disappears as it enters site, reappears briefly mid-site, and finally reappears again just before the tailings pond; dry streambed where the stream is not flowing.

Other surface water: Yes X, No     , Name(s)/Description: One pond is located below the concentrator and above tailings; pond is lined.

Waste materials within any floodplain: Yes X, No      Source ID(s): WR-3, -4, -5, and TP-1

Approximate Flood frequency? X 1 yr,      10 yr,      100 yr

Estimated seasonal flow of stream(s) (cfs)? 1.4 cfs

High Flow: 20 cfs, Average Flow: 2 cfs

Distance between waste source(s) and nearest surface water body (ft)? WR-3 lies across valley bottom; there was no water on dump during this site visit. Water flows over portions of WR-4, -5, and TP-1.

Surface water draining onto or through waste sources: Yes X, No     , Describe: See above

Surface water use within 15 miles downstream? (Drinking water supply, irrigation, residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?) Agricultural, fishery, wetland

Observed erosional/sedimentation/stream turbidity problems? Yes     , No X, Distance downstream (ft)?      Describe/explain (Note streambank stability and condition of streambank vegetation and any manmade structures or channel changes present): Adit discharge from WR-4 flows through waste rock; no effect off-site.



**SAMPLERS:** Babits

[illegible]

**FLOW: Estimated (E) or Measured (M)?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993):

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides?	(SO <sub>3</sub> )
Presence of evaporative salt deposits?	(ESD)
Discolored or turbid seepage?	(SPG)
Presence of long filamentous algae in drainages, mosses in moist areas?	
Presence of ferric hydroxide precipitates?	(FEOX)
Presence of burned or stressed vegetation?	(VEG)
pH ≤ 5.0	(pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? None

Wetlands present: Yes   , No X, Describe:                     

Carbonate rocks/soils: Yes X, No   , Describe: Soils were carbonaceous.

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10   ; 10-30   ; 30-100 X; 100-300   ; 300-1,000   ; 1,000-3,000   ; 3,000-10,000   ; 10,000 or greater   ; Comments                     

Nearest residence(ft or miles)? 100 feet (appears to be part-time)

For each source (table next page):

Available fine materials?      Surface area?

Uncovered and unvegetated?      Wet or dry?

Overall dust propagation potential:  
observed      high      moderate      low      none



**ACID DRAINAGE/AIR PATHWAY INVENTORY FORM**

**SAMPLERS:** Babits, Flammanq, Lasher

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIFE)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/FINE/NO DUST/LOW/NONE)
WR-1	SO3	Dry	45,000	42,750	No	None
WR-2	SO3	Dry	58,500	55,575	No	None
WR-3	SO3	Dry	68,400	64,980	No	None
WR-4	SO3	Dry	24,660	24,413	No	None
WR-5	SO3	Dry	28,800	28,512	No	None
TP-1	SO3	Partial	4,950	4,950	Yes	Moderate/Low
Adit #3	None	N/A	N/A	N/A	N/A	N/A
Adit #4	None	N/A	N/A	N/A	N/A	N/A

**Notes and Clarifications:** \_\_\_\_\_

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes X, No     ,  
Describe: House located approx. 100' to the east of the site; appears  
to be a part-time residence.

Population within 1 mile: 1-10 X; 10-30     ; 30-100     ; 100-300     ;  
300-1,000     ; 1,000-3,000     ; 3,000-10,000     ; 10,000 or greater     ;  
Comments     

Evidence of recreational use on site: Yes     , No X, Describe:     

Accessibility - Fences, warning signs, closed roads? Locked gates at  
both entrances; logging is being done around site and is easily access-  
ible to the loggers.

Sensitive environments on-site or adjacent to site:

State or National Parks - Yes     , No X, Comment       
Wilderness Area - Yes     , No X, Comment       
T&E Species Habitat - Yes     , No X, Comment       
Bat Habitat - Yes X, No     , Comment Possible

Primary Drainage X; Secondary Drainage     ; No Information     :

Riparian Habitat Quality - High X, Medium     , Low       
Wetlands Frontage - High X, Medium     , Low       
Fisheries Habitat and Species Classification - 4  
Sport Fishery Classification - 4

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes X, No     , Number 3, types and locations:       
Adit #4 is open; Adits #2 and #3 are partially caved, each have an  
opening approx. 3'x3'.

Hazardous structures: Yes X, No     , Number 9, types and locations:       
Collapsing cabins near Adit #1 and at south edge of site; two loadout  
structures near WR-2, one by adit associated with WR-3, and one near  
WR-4; wood structure on south side of WR-3 and one wood frame structure  
between WR-4 and pond; mill building.

Unstable highwalls, pits, trenches, slopes: Yes     , No X, Number     ,  
types and locations:     

Unstable waste piles, impoundments, undercut banks: Yes X, No     ,  
Number 5, types and locations: All waste rock piles have steep,  
unstable slopes.

Fire and/or Explosion hazards: Yes X, No     , Explain: Many wood  
structures

## Bibliography

- MBMG, East Pacific Mine, Broadwater County, Montana, Form 39, 1976-1986.
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- MBMG, Mines and Mineral Deposits (Except Fuels), Broadwater County, Montana, Information Circular 7592, Written by Glenn C. Reed, April 1951, pp. 34-42.
- MBMG, Title Unknown, Bulletin No. 30, Author Unknown, 1962, pp. 18-19.
- MBMG, Well Log Database, September 8, 1993.
- MDFWP, Montana Rivers Information System Rivers Report, Version 2.0, Prepared by Montana Natural Resource Information System, December 1989.
- MDHES, Sample Analysis Report for the East Pacific Mine, Prepared for U.S. Forest Service, June 14, 1993.
- USGS, Geology and Mineral Deposits, East Flank of the Elkhorn Mountains, Broadwater County, Montana, Professional Paper 665, Author Unknown, Date Unknown, p. 41.
- USGS, Title Unknown, Bulletin No. 842, Author Unknown, 1933, pp. 216-220.
- USGS, Topographic Map, Winston, Montana, 7 1/2 minute Quadrangle, 1986.



LABORATORY ANALYTICAL DATA

EAST PACIFIC  
PA NO. 04-008





# SOLID MATRIX ANALYSES

Results per dry weight basis

Metals in soils

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
04-008-SE-1	30 J	124	1.1 U	13.5 J	36 J	88.3 J	27400	0.175 J	763 J	24 J	49	13 UJ	133 J	0.59 U
04-008-SE-2	365 J	73.3	31	13.6 J	40 J	347 J	27200	0.227 J	2350 J	32 J	2690	42 J	6120 J	0.298 U
04-008-TP-1	458 J	64.2	32	11.5 J	35 J	399 J	31600	0.256 J	2510 J	33 J	4760	33 J	5550 J	0.283 U
04-008-WR-1	575 J	107	48	20.2 J	95 J	980 J	42100	0.608 J	1620 J	101 J	6160	116 J	8240 J	NR
04-008-WR-2	236 J	56.9	53	13.5 J	33 J	475 J	38600	0.789 J	1710 J	28 J	4250	34 J	6950 J	NR
04-008-WR-3	214 J	65.3	36	11.4 J	11 J	213 J	32700	0.325 J	1680 J	13 J	4000	18 J	4650 J	NR
BACKGROUND	85	63.2	0.7	1.9 U	1.9	11.6	9000	0.011 J	470	3 U	77	6 UJ	74	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

## Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL SULFUR ACID BASE 1/1000	NEUTRAL POTENT. 1/1000	SULFUR ACID BASE POTENT. 1/1000	SULFATE %	PYRITIC %	ORGANIC SULFUR %	PYRITIC ACID BASE 1/1000	SULFUR ACID BASE POTENT. 1/1000
04-008-TP1-DUP	0.86	26.9	73.3	46.5	<0.01	0.56	0.34	17.5	55.8
04-008-TP-1	0.88	27.5	73.3	45.8	<0.01	0.53	0.35	16.6	56.8
04-008-WR-1	0.58	18.1	22.3	4.16	0.22	0.05	0.31	1.56	20.7
04-008-WR-2	3.42	107	93.0	-13.9	0.60	1.22	1.80	38.1	54.9
04-008-WR-3	3.00	93.7	86.7	-7.02	0.42	1.43	1.15	44.7	42.0

# WATER MATRIX ANALYSES

Results in mg/L

Metals in Water

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO3/L) CALC.	HARDNESS
04-008-SW-1	1.69 U	3.9	2.57 U	9.7 U	6.83 U	3.6 J	25.3 J	0.12	4.08 U	12.7 U	1.55 U	30.7 U	7.57 U	30.5
04-008-SW-2	9.59	10.9	12.8	9.7 U	6.83 U	10.7 J	191 J	0.11	33.9	12.7 U	72.6	30.7 U	939 UJ	102
04-008-SW-3	6.35	4.6	8.9	9.7 U	6.83 U	4.9 J	16.1 J	0.12	5.57	12.7 U	2.88	30.7 U	774 UJ	196

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

## Wet Chemistry

Results in mg/l

TOTAL DISSOLVED SOLIDS

FIELD ID	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
04-008-SW-1	97	< 5.0	0.1	< 0.00
04-008-SW-2	201	< 5.0	72	< 0.00
04-008-SW-3	320	< 5.0	139	0.4

## LEGEND

SE1 - 100 feet upgradient of waste rock dump 3 in Spring Creek.  
SE2 - 100 feet downgradient of tailings in Spring Creek.  
TP1 - Composite of subsamples TP-1A-A, B, C, TP1B-B, and A.  
WR1 - Composite of subsamples WR1A, B, C, WR2A, B, and C.  
WR2 - Composite of subsamples WR2A and 3B.  
WR3 - Composite of subsamples WR4A, B, WR5A, B, and C.  
BACKGROUND - From Voshog (04-014-SSI).  
TP1-DUP - Duplicate of 04-008-TP-1.

SW1 - Same as SE1.  
SW2 - Same as SE2.  
SW3 - Add discharge at waste rock dump 4.



**XRF ANALYSIS RESULTS**

**EAST PACIFIC  
PA NO. 04-008**



Mine Name: East Pacific PA# 04-008  
XRF Field Analyses  
Results in PPM

XRF SAMPLE ID	CrHl	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
04-008-SE-3		15945.9	21372.9	1774.68		1521.23	26777.8		174,126 *	3655.45	128,469 *	391.02
04-008-TP1A-A			29848.5	2075.72	185.185 *	36181.6 *	36181.6 *	339,905 *	267.73	4197.05		408.69
04-008-TP1A-B			38616.5	2650.87		3199.17	40565.4	501,088 *	403,422	7782.12		272,064
04-008-TP1A-C			34004	2100.36	202,906 *	2668.85	33798.2	270,993 *	204,693	4833.19	175,033 *	353,568
04-008-TP1B-A			28133.5	1860.92		2436.96	33791.6	200,993 *	274,993	4109.05	201,689 *	356,244
04-008-TP1B-B			44005.5	2303.05	173,654 *	3149.82	41199	346,356 *	454,297	5236.52		351,656
04-008-TP1B-C			30418.1	1967.8		2690.98	35039.1		265,454	4940.92	210,591 *	344,614
04-008-TP-1-COMP			26249.9	2752.35	434,757 *	1889.45	74234.7		1444.91	5491.69	331,953 *	432,181
04-008-WR1-A	399,485 *		16414.1	2394.43		3142.74	67713.6	496,877 *	1213.07	8911.54		272,062
04-008-WR1-B			23860.5	1885.86		2961.52	57432.3	497,439	487,439	8350.71		417.63
04-008-WR2-A			16486.9	2295.87	215,773 *	1792.83	61507	579,488 *	1060.13	8118.83	289,192 *	333,338
04-008-WR2-B			15318.2	2263.15		3791.53	64922.3		1560.13	15348.6	446,072 *	266,851
04-008-WR2-C			27446.3	1636.37		2701.68	69025.4		262,361 *	6291.1		377,881
04-008-WR3-A			39680.2	1710.02		42155.3			647,746	15879.9		243,782
04-008-WR3-B			30212.4	1332.15		39313.9			429,221	15307.9		212,549
04-008-WR4-A			15365	2318.99		39934.3						
04-008-WR4-B			19423.4	1528.17		3414.61						
04-008-WR5-A			23284.6	1584.44		34931.5						
04-008-WR5-B			25802.5	1398.5		2292.48						
04-008-WR5-C			8602	1248		2413.52						
04-008-WR-1-COMP	640,385 *		16782	1248	159	6389	60034	167	139,602 *	5120.5	55,598 *	983,909
04-008-WR-2-COMP			27123	1538	93	3079.39	68100.4	538,365 *	76,5424 *	2980.74	648,743	315,704
04-008-WR-3-COMP			14987	1631	115	3123	48840	340	1462.45	8478.08	177	211
04-008-WR-3-COMP						2560	36285	248	384	9273	156	268
									337	5796	271	317
	Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th	
04-008-SE-3	141,956			1475.54	105,873			668,223	135,562 *		10,6193 *	
04-008-TP1A-A	138,189			2103.68	107,079	174,387 *	62,6107 *	611,012	136,46 *		16,2703 *	
04-008-TP1A-B	136,981			4059.16	118,104		136,465 *	452,254	175,69 *		14,0657 *	
04-008-TP1A-C	149,016		5,06728 *	2074.3	109,541	216,758 *		578,291	177,371 *			
04-008-TP1B-A	157,608			1962.79	103,392		53,6473 *	635,363	131,669 *		18,1697 *	
04-008-TP1B-B	112,521			4296.07	89,6692	89,4774 *		518,329	200,232 *		19,3009 *	
04-008-TP-1-COMP	143,86			2720.9	115,944			570,739	171,514 *			
04-008-WR1-A	108,72			2529.38	72,3803	282,961 *		512,385	187,864 *		26,8474 *	
04-008-WR1-B	114,248		6,40541 *	8198.13	97,272	314,316 *	316,514	341,401	285,649 *			
04-008-WR2-A	119,181			2254.1	101,7655	254,562 *	98,1271 *	568,849	197,14 *			
04-008-WR2-B	149,708			6554.63	72,4344	151,431 *	299,98	410,591	187,705 *			
04-008-WR2-C	115,279			5960.78	104,916	308,295 *	204,098 *	431,772	235,865 *		21,294 *	
04-008-WR3-A	120,207			3758.61	75,0354	187,551 *	71,7228 *	559,197	200,378 *			
04-008-WR3-B	97,8438			3846.99	76,5731	209,307 *	140,438 *	478,893	206,544 *			
04-008-WR4-A	93,3469			5762.47	67,3221	290,826 *	51,991 *	333,196	263,677 *			
04-008-WR4-B	207,01				72,588			866,57	85,0545 *		11,693 *	
04-008-WR5-A	121.5			2037.18	68,3716	153,396 *		540,619	130,085 *			
04-008-WR5-B	115,471			3990.16	86,3202		54,5365 *	552,829	134,916 *			
04-008-WR5-C	135,318			2288.04	78,6594			533,958	93,8246 *			
04-008-WR-1C	155			7962	123	214	397	490	285		14	
04-008-WR-1-COMP	136,805		8,94818 *	7201.57	94,1324	365,314 *	344,866	543,276	190,354 *		19,7979 *	
04-008-WR-2-COMP	106			4029	79	348	79	475	251		14	
04-008-WR-3-COMP	130			2850	80	225		427	99		9	

\* - Estimated Quantity  
\$ - Unvalidated Data





ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

EAST PACIFIC  
PA NO. 04-008



# **AIMSS SCORESHEET**

**SITE NAME:**

**EAST PACIFIC**

**PA NUMBER:**

**04-008**

LINE NO.		<b>GROUNDWATER PATHWAY</b>	
1		OBSERVED RELEASE	0
2		EXCEEDENCES	0
3A	<b>GW - LIKELIHOOD OF RELEASE</b>	CONTAINMENT	20
3B		GW DEPTH	20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B 400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C 400
5	<b>GW - WASTE CHAR.</b>	<b>CALCULATED SCORE</b>	<b>(SEE WORKSHEET)</b> 341.956
6		WELLS - 1 MI. x 2.5	0.0
7	<b>GW - TARGETS</b>	WELLS - 1 TO 4 MI	74
8		NEAREST WELL	10
9		TARGETS SCORE	LINES 6 + 7 + 8 84.0
10		<b>GROUNDWATER SCORE</b>	<b>LINES 4 x 5 x 9</b> 11489722
		<b>SURFACE WATER PATHWAY</b>	
11		OBSERVED RELEASE	300
12	<b>SW - LIKELIHOOD OF RELEASE</b>	EXCEEDENCES	100
13A		CONTAINMENT	20
13B		DISTANCE TO SW	20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B 400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C 800
15	<b>SW - WASTE CHAR.</b>	<b>CALCULATED SCORE</b>	<b>(SEE WORKSHEET)</b> 375.708
16		DRINKING WATER POP'N	0
17		IMPACTED DRAINAGE	0
18	<b>SW - TARGETS</b>	WETLANDS	10
19		FISHERY	1
20		RECREATION	5
21		IRRIGATION/STOCK	2
22		T & E SPECIES HABITAT	0
23		TARGETS SCORE	SUM LINES 16 - 22 18
24		<b>SURFACE WATER SCORE</b>	<b>LINES 14 x 15 x 23</b> 5410195
		<b>AIR PATHWAY</b>	
25		OBSERVED RELEASE	0
26A	<b>AIR - LIKELIHOOD OF RELEASE</b>	CONTAINMENT	15
26B		DISTANCE TO POPULATION	20
26C		POTENTIAL TO RELEASE	LINES 26A x 26B 300
27		LIKELIHOOD SCORE	LINES 25 + 26C 300
28	<b>AIR - WASTE CHAR.</b>	<b>CALCULATED SCORE</b>	<b>(SEE WORKSHEET)</b> 1.765
29		POPULATION - 4 MILES	30
30	<b>AIR - TARGETS</b>	NEAREST RESIDENCE	10
31		WETLANDS	10
32		PARKS / WILDERNESS	0
33		T & E SPECIES HABITAT	0
34		TARGETS SCORE	SUM LINES 29 - 33 50
35		<b>AIR PATHWAY SCORE</b>	<b>LINES 27 x 28 x 34</b> 26475
		<b>DIRECT CONTACT PATHWAY</b>	
36		OBSERVED EXPOSURE	200
37A	<b>LIKELIHOOD OF EXPOSURE</b>	ACCESSIBILITY	5
37B		DISTANCE TO POPULATION	20
37C		POTENTIAL EXPOSURE	LINES 37A x 37B 100
38		LIKELIHOOD SCORE	LINES 36 + 37C 300
39	<b>D. C. WASTE CHAR.</b>	<b>CALCULATED SCORE</b>	<b>(SEE WORKSHEET)</b> 1.604
40	<b>DIRECT CONTACT TARGETS</b>	POPULATION - 1 MILE	1
41		NEAREST RESIDENCE	10
42		RECREATIONAL USE	0
43		TARGETS SCORE	SUM LINES 40 - 42 11
44		<b>DIRECT CONTACT SCORE</b>	<b>LINES 38 x 39 x 43</b> 5293
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>		
	(LINES 10 + 24 + 35 + 44) / 100,000		<b>169.32</b>

LINE NO.			SITE NAME:	EAST PACIFIC
			PA NUMBER:	04-008
	<b>SITE SAFETY</b>			
1	THREAT	ACCESSIBILITY		5
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	150
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	360
6		EXPLOSIVES		0
7		HAZ. MATERIALS		100
8		HAZARDS SCORE	SUM LINES 2 - 7	610
9		POPULATION - 1 MILE		1
10	TARGETS	NEAREST RESIDENCE		10
11		RECREATIONAL USE		0
12		TARGETS SCORE	SUM LINES 9 - 11	11
13		<b>SITE SAFETY SCORE</b>	<b>(LINES 1 x 8 x 12) / 1,000</b>	<b>33.55</b>

**SUMMARY OF HISTORICAL ANALYTICAL DATA  
FROM OTHER SOURCES**

STATE OF MONTANA  
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES  
COGSWELL BUILDING  
HELENA MONTANA, 59620-0901

TOWNSEND RD.  
Rec'd

JUN 16 '93

LABORATORY SYSTEM

ACCOUNT: T052530A ATTN:

FOREST SERVICE OFFICE  
415 SO. FRONT  
TOWNSEND

FOR: FOREST SERVICE OFFICE

MT 59644

INFO	ACT
Manager	
Asst. Mgr.	
Lab. Mgr.	
Quality Contr.	
Spec. Mgr.	
Training	

\*\*\*SAMPLE ANALYSIS REPORT\*\*\*

June 14, 1993

lab#	testname	sampleid	date	reported	units
C9305-101622	ALKALINITY IN WATER	WEASEL CR LOWER	05/19/93	37.2	MG/L
C9305-101622	ARSENIC	WEASEL CR LOWER	05/19/93	0.032	MG/L
C9305-101622	CALCIUM	WEASEL CR LOWER	05/19/93	31.4	M
C9305-101622	CADMIUM	WEASEL CR LOWER	05/19/93	0.007	MG/L
C9305-101622	CHLORIDE IN WATER	WEASEL CR LOWER	05/19/93	2.1	MG/L
C9305-101622	COPPER	WEASEL CR LOWER	05/19/93	0.046	MG/L
C9305-101622	FLUORIDE IN WATER	WEASEL CR LOWER	05/19/93	0.13	MG/L
C9305-101622	IRON	WEASEL CR LOWER	05/19/93	1.71	MG/L
C9305-101622	HARDNESS GRAINS PER GALLON	WEASEL CR LOWER	05/19/93	5.4	G/PG
C9305-101622	TOTAL HARDNESS AS CaCO3	WEASEL CR LOWER	05/19/93	92.9	MG/L
C9305-101622	POTASSIUM	WEASEL CR LOWER	05/19/93	1.8	MG/L
C9305-101622	MAGNESIUM	WEASEL CR LOWER	05/19/93	3.5	MG/L
C9305-101622	MANGANESE	WEASEL CR LOWER	05/19/93	0.133	MG/L
C9305-101622	SODIUM	WEASEL CR LOWER	05/19/93	4.8	MG/L
C9305-101622	NITRATE PLUS NITRITE AS N	WEASEL CR LOWER	05/19/93	0.56	MG/L
C9305-101622	ORTHO-PHOSPHORUS	WEASEL CR LOWER	05/19/93	0.109	MG/L
C9305-101622	LEAD	WEASEL CR LOWER	05/19/93	0.132	MG/L
C9305-101622	PH IN WATER	WEASEL CR LOWER	05/19/93	7.81	UNITS
C9305-101622	SILICA IN WATER BY ICP	WEASEL CR LOWER	05/19/93	23.2	MG/L
C9305-101622	SULFATE IN WATER	WEASEL CR LOWER	05/19/93	44.1	MG/L
C9305-101622	SPECIFIC CONDUCTANCE	WEASEL CR LOWER	05/19/93	194	UMHOS
C9305-101622	ZINC	WEASEL CR LOWER	05/19/93	0.806	MG/L
C9305-101623	ALKALINITY IN WATER	HELLGATE	05/20/93	218	MG/L
C9305-101623	ARSENIC	HELLGATE	05/20/93	< 0.001	MG/L
C9305-101623	CALCIUM	HELLGATE	05/20/93	48.6	MG/L
C9305-101623	CADMIUM	HELLGATE	05/20/93	< 0.001	MG/L
C9305-101623	CHLORIDE IN WATER	HELLGATE	05/20/93	1.4	MG/L
C9305-101623	COPPER	HELLGATE	05/20/93	< 0.01	MG/L

APPROVED BY: DLB

\*\*\*FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-2642



June 14, 1993

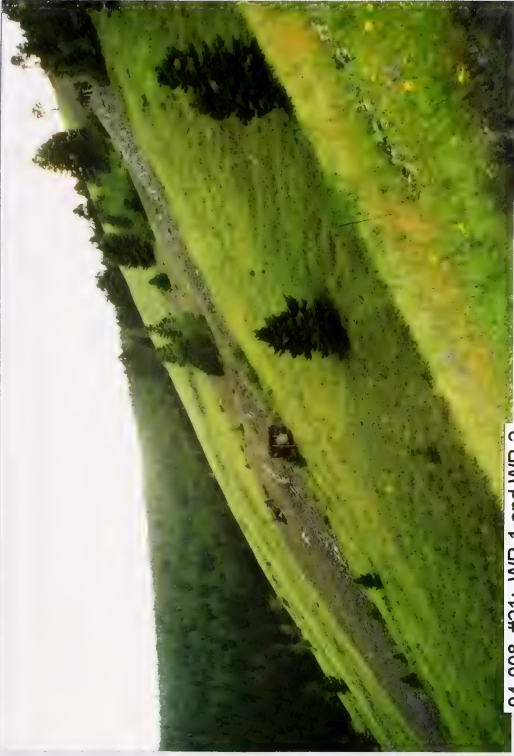
testname	sampleid	date	reported	units
9305-101625 TOTAL HARDNESS AS CaCO <sub>3</sub>	INDIAN CR UPPER			F
9305-101625 BICARBONATE	INDIAN CR UPPER		51.7	MG/L
9305-101625 POTASSIUM	INDIAN CR UPPER		17	MG/L
9305-101625 MAGNESIUM	INDIAN CR UPPER		0.5	MG/L
9305-101625 MANGANESE	INDIAN CR UPPER		2.3	MG/L
9305-101625 SODIUM	INDIAN CR UPPER		0.115	MG/L
9305-101625 NITRATE PLUS NITRITE AS N	INDIAN CR UPPER		2.1	MG/L
9305-101625 ORTHO-PHOSPHORUS	INDIAN CR UPPER		0.05	MG/L
9305-101625 LEAD	INDIAN CR UPPER		0.031	MG/L
9305-101625 PH IN WATER	INDIAN CR UPPER		0.016	MG/L
9305-101625 SILICA IN WATER BY ICP	INDIAN CR UPPER		7.4	UNITS
9305-101625 SULFATE IN WATER	INDIAN CR UPPER		14.3	MG/L
9305-101625 SPECIFIC CONDUCTANCE	INDIAN CR UPPER		26.1	MG/L
9305-101625 ZINC	INDIAN CR UPPER		100	UMHOS
9305-101626 ALKALINITY IN WATER	WEASEL CR. UPPER		0.822	MG/L
9305-101626 ARSENIC	WEASEL CR. UPPER		31.6	MG/L
9305-101626 CALCIUM	WEASEL CR. UPPER		0.034	MG/L
9305-101626 CADMIUM	WEASEL CR. UPPER		23	MG/L
9305-101626 CHLORIDE IN WATER	WEASEL CR. UPPER		0.002	MG/L
9305-101626 COPPER	WEASEL CR. UPPER		1.1	MG/L
9305-101626 FLUORIDE IN WATER	WEASEL CR. UPPER		< 0.01	MG/L
9305-101626 IRON	WEASEL CR. UPPER		< 0.10	MG/L
9305-101626 HARDNESS GRAINS PER GALLON	WEASEL CR. UPPER		1.24	MG/L
9305-101626 TOTAL HARDNESS AS CaCO <sub>3</sub>	WEASEL CR. UPPER		4.1	G/PG
9305-101626 POTASSIUM	WEASEL CR. UPPER		70.6	MG/L
9305-101626 MAGNESIUM	WEASEL CR. UPPER		1.5	MG/L
9305-101626 MANGANESE	WEASEL CR. UPPER		3.2	MG/L
9305-101626 SODIUM	WEASEL CR. UPPER		0.142	MG/L
9305-101626 NITRATE PLUS NITRITE AS N	WEASEL CR. UPPER		3.8	MG/L
9305-101626 ORTHO-PHOSPHORUS	WEASEL CR. UPPER		0.94	MG/L
9305-101626 LEAD	WEASEL CR. UPPER		0.079	MG/L
9305-101626 PH IN WATER	WEASEL CR. UPPER		0.034	MG/L
9305-101626 SILICA IN WATER BY ICP	WEASEL CR. UPPER		7.68	UNITS
9305-101626 SULFATE IN WATER	WEASEL CR. UPPER		21.9	MG/L
9305-101626 SPECIFIC CONDUCTANCE	WEASEL CR. UPPER		35	MG/L
9305-101626 ZINC	WEASEL CR. UPPER		166	UMHOS
			0.345	MG/L

APPROVED BY: DLB  
 FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-2642





04-008, #20: WR-1 and WR-2



04-008, #21: WR-1 and WR-2



MONTANA DEPARTMENT OF STATE LANDS  
ABANDONED MINE RECLAMATION BUREAU

HAZARDOUS MATERIALS INVENTORY  
SITE INVESTIGATION LOG SHEET

Mine/Site Name: VOSBURG PA#: 04-014

Date: July 27, 1993 Time: 0830

Field Team Leader: Babits, Pioneer

Sampling Personnel: Flammang, Pioneer  
Lasher, Pioneer

Visitors: None

Weather/Seasonality Observations: Cool to warm (45°-60°F);  
breezy (0-10 mph); partly cloudy; cool, wet spring and summer.

Photographic Log (Film Roll and Photo No.'s/Video Tape Number): #18: WR-5 and  
tailings; #19: WR-3. Video Tape No. 1

General Comments/Observations (not covered specifically in attached Inventory Forms):  
N/A

Other Hazardous Materials/Substances Present: N/A

General Comments on Potential Remedial Alternatives: Flatten  
tailings piles, revegetate with coversoil; reprocess tailings and  
waste rock.





## I. BACKGROUND INFORMATION

This information is to be collected to the extent practical prior to conducting the Site Investigation. Data gaps shall be filled in during the investigation.

Mine/Site Name(s): VOSBURG PA#: 04-014

Legal Description: T 8N ; R 1W ; Sec. 34 , SW 1/4 SW 1/4 1/4

County: BROADWATER Mining District: WINSTON

Latitude: N 46° 23' 58" Longitude: W 111° 43' 11"

Primary Drainage Basin and Code: Beaver Creek/10030101

Secondary Drainage Basin: Badger Creek

USGS Quadrangle map name(s): Winston

Mine Type/Commodities: Hardrock/Gold, Lead, Silver, Zinc

Activity Status: Active      , Inactive/Exploration      , Abandoned X .

Ownership status: Known YX N ; private/public? Public  
Owner, Agent, or Contact (Include address and phone when available): BLM; Helena  
National Forest.

Relationship to other mines/sites in the area/district: Veins from  
Vosburg mines can be traced to veins on Little Olga mine, part of  
the Kleinschmidt Group. See list under mill history for those  
mines claimed by same owner in same area.

Regulatory Status (Activity by other agencies)? Hardrock permits?  
Past Reclamation Activities? N/A

General site features: Elevation 7000'-7400' , Slope 20°-30° ,  
Aspect Northwest

Land use: Mining X , Recreational X , Residential      , Urban      ,  
Agricultural      , Other (Specify)     

Area of disturbed/unvegetated lands? 3 acres.  
Dimensions:     

Predominant vegetation types: Ponderosa pine, Douglas fir

Access: roads - good X , poor      , 4wd      , trail      .  
Other logistical considerations (proximity to other sites). Near  
East Pacific, and Kleinschmidt Group

Well logs within 1 mile radius; water rights 15 mi downstream (Attach  
HBMG Well Log Printout(s): There is 1 well log within a 1 mile radius.

General site geologic, hydrologic, and hydrogeologic settings (Also  
note presence of radioactive minerals). Site lies on east bank of perennial Badger  
Creek which drains to northwest into the perennial South Fork of  
Beaver Creek. Mine lies in the Vosburg or Little Olga Stock, a  
porphyritic quartz monzonite also identified as a granodiorite cut  
by two sets of ore bearing veins.

Mining/milling history, ore type/tenor, host rock, gangue: Mining  
took place from 1933 to approx. 1941; adits were in bad shape in  
1938. Host rock is generally porphyritic quartz monzonite. Miner-  
alization occurs in two sets of quartz veins. Ore to 1938 was  
found in the oxidized zone, Au and Ag in hematite with some Pb and  
Zn sulfides, also Cu appearing in lower workings. Production  
records for 1933-1941 indicate 24,000 tons of ore were produced  
averaging 0.28 oz. Au, 1.5 oz. Ag, and minor amounts of Pb, Zn, Cu.  
Gangue minerals appear to be quartz with minor amounts of calcite  
in some places.

#### Mine Operation?

Shafts - Yes     , No X, #     , Comment       
Adits - Yes X, No     , # 7, Comment All caved; 2 with water  
Pits - Yes     , No X, #     , Comment       
Placers - Yes     , No X, #     , Comment       
Other - Yes     , No X, #     , Comment     

Mill Operation? Yes X, No     . If yes answer the next three  
questions:

Period(s) of Operation: 1936 to possibly 1937

Origin of Ore Milled - Custom Mill      Dedicated Mill X; Number and  
names of mines that supplied mill feed: Vosburg Mine; other  
possibilities because of ownership and location include: Calhoun,  
Mary V, Mary V No. 2, Mary V No.3, Cataract, Tramway, Tramway  
Extension, Lame Deer, and the Lame Deer Extension.

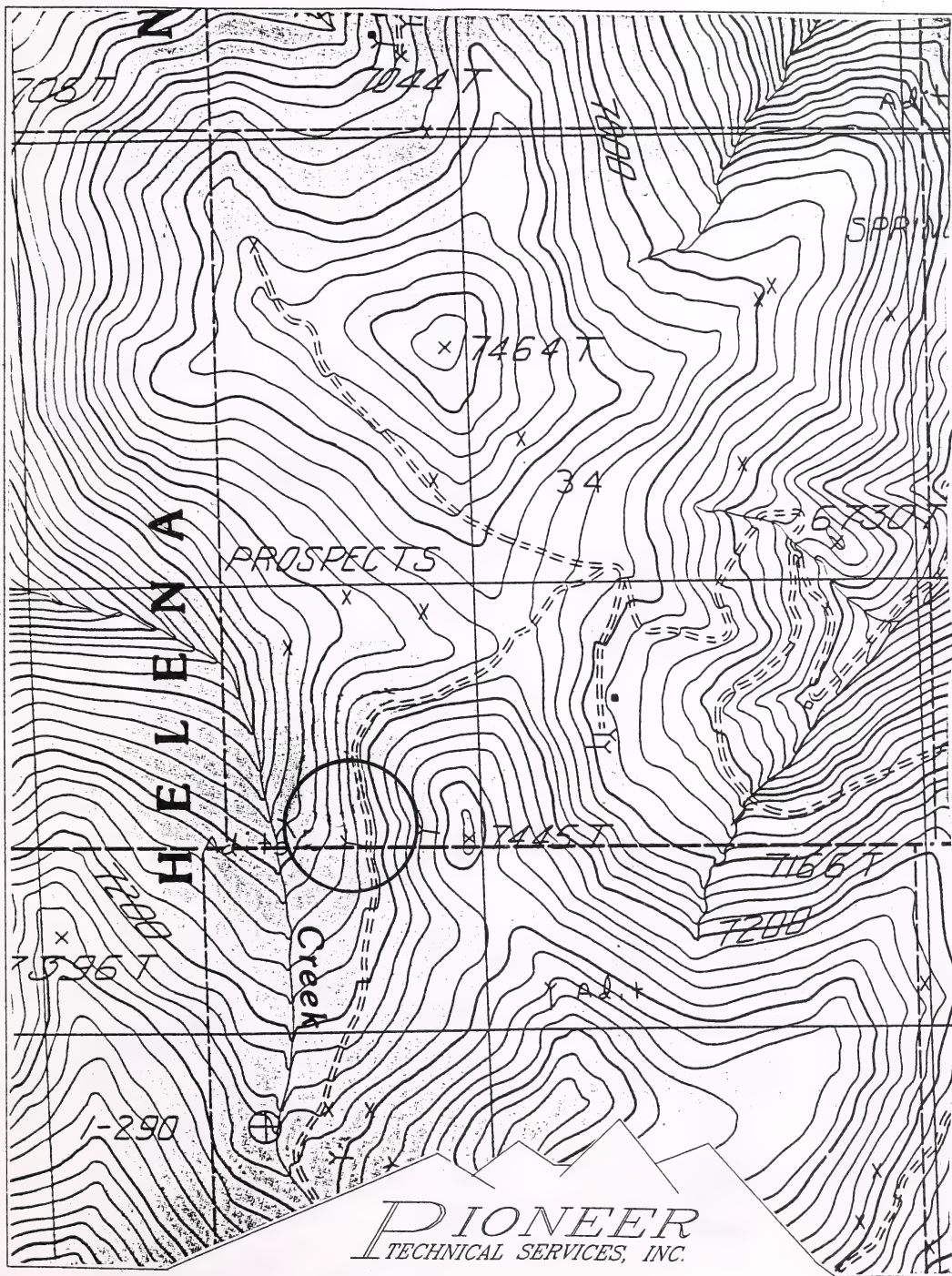
Process? Hg-amalgam, CN<sup>-</sup> leach (vat, heap), floatation, smelting?  
50-ton cyanide plant; by 1938 14,000 tons had been treated in the  
mill. Reports indicated that Cu sulfides interfered with recovery  
of all metals. Mill dismantled by 1950's.

Montana Bureau of Mines and Geology  
Water Well Log Data

06/10/1993

Well No.: M:57138  
Location: 08N 01W 28 D  
Site Name: WILLIAMS HAROLD  
County: Broadwater  
Depth: 101.0  
Field: 30.0  
Static Water Level: 40.00  
Pumping Water Level: 96.0  
Year drilled: 1986  
Driller:  
Driller's License: 253  
NRC Well No.:





**PIONEER**  
TECHNICAL SERVICES, INC.

VOSBURG, P.A. NO. 04-014

T08N, R01W, SECTION 34

SCALE: 1" = 1000'







SAGGER CREEK

1 TO 2 FEET  
OF TAILINGS  
BETWEEN POND

TP2  
VOL=30,000 CU. YDS.  
AREA=3700 SQ. YDS.

FOUR HOLES  
COMPOSITED  
TO MAKE  
TP1B

TP1  
VOL=22,000 CU. YDS.  
AREA=3000 SQ. YDS.

FOUR HOLES  
COMPOSITED  
TO MAKE  
TP1A

CONCRETE  
FOUNDATION

TP3  
VOL=12,000 CU. YDS.  
AREA=1770 SQ. YDS.

DISCHARGE  
DRAIN  
SLOPE SURFACE

WM  
VOL=14,800 CU. YDS.  
AREA=2140 SQ. YDS.

WM  
VOL=2800 CU. YDS.  
AREA=285 SQ. YDS.

DISCHARGE  
DRAIN  
SLOPE SURFACE

WM  
VOL=460 CU. YDS.  
AREA=285 SQ. YDS.

WM  
VOL=100 CU. YDS.  
AREA=80 SQ. YDS.

0 30' 60' 90'  
SCALE

10 CU. YDS.

10 CU. YDS.

10 CU. YDS.

10 CU. YDS.

TO WINSTON

### LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
—	CULVERT	—	OPEN ADIT
*	LIGHT (LIGHT POLE)	—	COLLAPSED ADIT
o	UTILITY POLE	—	OPEN SHAFT
o	CENTERLINE MONUMENT	—	COLLAPSED SHAFT
o	DECIDUOUS TREE	—	DICARTON
o	CONIFEROUS TREE	—	WHITE ROCK CLUMP
—	WOOD FENCE	—	COLLAPSED TIMBERS
—	WIRE FENCE	—	RAILS
—	BUILDING	—	SOIL SAMPLE
—	BANNER POST	—	TOX SAMPLE
—	GATE	—	WATER SAMPLE
—	EDGE OF ASPHALT	—	GROUND AND SURFACE
—	EDGE OF GRAVEL	—	DRAINAGE
—	SLOPE DIRECTION	—	WATER WELL

MONTANA DEPT. OF STATE LANDS  
HAZARDOUS MATERIAL INVENTORY  
VOSBURG PA# 04-014  
WINSTON DISTRICT BROADWATER COUNTY

**PIONEER**  
ENGINEERING

**TBS&H**

DATE: 22 SEPT. 83  
JOB NO. 83-17  
F.B. NO.

DESIGNED: TCR  
APPROVED: MUR

THOMAS, DEAN & HOSKINS INC.  
ENGINEERING CONSULTANTS  
GREAT FALLS—BOZEMAN—KALISPELL  
SPOKANE MONTANA WASHINGTON



## II. INFORMATION COLLECTED ON SITE

### A. SOLID MATRIX WASTE CHARACTERIZATION

#### 1. Waste Characteristics - Use table on following page.

Unique source identification (e.g. west waste rock dump #2) and abbreviation on sketch map and source list (e.g. WWRD2). Locate source on sketch map with any measured distances from at least two landmarks.

Source types: Waste rock dumps and piles (WR); tailings impoundments and piles (TAIL); vats, vessels, tanks that contain something (VAT); barrels - not empty (BAR); soils contaminated by spills or leaks (SP); suspected asbestos containing materials (ACM); garbage/refuse/junk dumps (DMP); other sources (OTH).

Source size: Estimated volumes (cu. yards or feet, # of barrels) for each source identified above.

Location/Description: List location and description for each source identified above.

Waste containment: Is the source contained with respect to groundwater, surface water, and airborne releases or the potential to release? Good, adequate, poor, or none. Are waste structures / vessels sound, are runoff controls in place, are wastes covered or vegetated, pond liners intact?

#### 2. TAILINGS IMPOUNDMENTS - If tailings impoundments are also present, complete the following questions.

Describe the tailings grain size distribution (approximate % sand, silt, & clay): \_\_\_\_\_  
Sand, sandy clay, and clay

Determine tailings impoundment depth and describe stratification of the tailings if observable (based on texture and color): Deepest depth is 6.5'; no impoundment seen.

Are tailings wet or dry (Describe location of partially wetted tailings impoundments): Wet

Describe condition of the tailings impoundment (Note condition of dams or structures, location of breaches): No impoundment seen; tailings are in piles.

Comments on potential for mitigation: Reprocess or flatten, coversoil, amend, and seed.

# SOURCE INVENTORY FORM

SAMPLERS: Lasher\*

SOURCE I.D. NO.	SOURCE TYPE	SOURCE VOLUME (yd <sup>3</sup> )	LOCATION/DESCRIPTION	CONTAINMENT	pH SD (D/S)	RADIO-ACTIVITY (MR/HR)	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
WR-1	WR	100	North side of pile	None	6.6 (D)	0.08	04-014-WR-1	07/27/93 1815	T-Metals, ABA
WR-2A	WR	450	South side of pile	None	6.4 (D)	0.07			
WR-2B	WR		North side of pile	None	6.4 (D)	0.08			
WR-3A	WR	2,800	Just above main road to Winston	None	6.8 (D)	0.06	04-014-WR-2	07/27/93 1825	T-Metals, ABA
WR-3B	WR		Just above main road to Winston	None	6.3 (D)	0.07			
WR-4A	WR	14,500	North side of pile, near road	None	6.0 (D)	0.06	04-014-WR-3	07/27/93 1840	T-Metals, ABA
WR-4B	WR		South side of pile, near road	None	6.0 (D)	0.07			
WR-5A	WR	12,000	North side of pile	None	< 3.5 (D)	0.05			
WR-5B	WR		Middle of pile	None	5.6 (D)	0.07			
WR-5C	WR		South side of pile	None	5.4 (D)	0.07			
WR-5D	WR		East of WR-5C	None	4.8 (D)	0.06			
SS-1	BEGRND	N/A	Background soil above WR-1	N/A	6.6 (D)	0.07	04-014-SS-1	07/27/93 0930	T-Metals

\* Direct reading (Battery Meter); S-Saturated Paste (Osm Meter)

Comments or deviations from SOPs: 04-014-WR-1 is composite of WR-1, and WR-2A and -2B.  
 04-014-WR-2 is composite of WR-3A and -3B. 04-014-WR-3 is composite of WR-4A and -4B, and WR-5A through -5D.

\*Continued on next page



**SAMPLERS:** Lasher

[illegible]

P-Direct reading (Kelway Meter) ; B-Saturated Paste (Orion Meter)

Comments or deviations from SOPs: 04-014-TP-1 is composite of TP-1A, TP-1B, TP-2A-A and -2A-B, and TP-2B-A.

## B. GROUNDWATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map.

Flowing adits: Yes X, No   , Number: 2 Identification: At WR-3 and WR-5

Filled shafts: Yes   , No X, Number:    Identification:   

Seeps/Springs: Yes X, No   , Number: 1 Identification: Expression of the adit discharge

Groundwater wells within 5 miles?: Yes X, No   ;

Number of well logs: 973

Distance to nearest well used for drinking? 2 miles

Sample types: Flowing adits (AD); filled shafts (SH);  
Residential wells (RW); Monitoring wells (MW); Seeps/Springs (SP).

Field Measurements: Flow (measured or estimated), pH (meter), Eh (meter), SC (meter), temperature (meter), Alkalinity (test kit)?

Potential for groundwater contamination (explain)?

Definite   , Probable   , Possible X, Unlikely   .

Uncontained sources; adit discharges have alkaline pH, but elevated Al concentrations; surface water has elevated metals as do sediments, tailings, and waste rock.

Other observations/notes: N/A



**SAMPLERS:** Babits, Flammang, Lasher

**FLOW: Estimated (E) or Measured (M) from adit, shaft, seep or spring?**

Comments or Deviations from the SOPs (Pioneer SAP, 1993): Adit discharges were not collected prior to flow. NM = Not Measured.

### C. SURFACE WATER CHARACTERISTICS

Use table on following page. Identify all locations on sketch map or topographic map. Indicate drainage patterns (run-on/runoff) and directions on sketch maps.

Flowing streams: Yes X, No    , Name(s): Badger Creek

Dry streambeds: Yes    , No X, Name(s):                     

Other surface water: Yes X, No    , Name(s)/Description: Flowing  
adits; adit at WR-5 has discharge which enters Badger Creek, adit at  
WR-3 has discharge but no surface water route is seen.

Waste materials within any floodplain: Yes X, No     Source ID(s): Tailings in Badger Creek

Approximate Flood frequency? X 1 yr,     10 yr,     100 yr

Estimated seasonal flow of stream(s) (cfs)? 1.25 cfs

High Flow: 15 cfs, Average Flow: 1.5 cfs

Distance between waste source(s) and nearest surface water body (ft)? 0 feet

Surface water draining onto or through waste sources: Yes X, No    ,  
Describe: Adit associated with WR-5 flows through the dump and  
tailings.

Surface water use within 15 miles downstream? (Drinking water supply, irrigation,  
residential use? Sensitive environments within 15 miles downstream? Park, Wilderness, Fishery, Wetland, T&E habitat?)  
Wetland, irrigation, fishery

Observed erosional/sedimentation/stream turbidity problems? Yes X,  
No    , Distance downstream (ft)? 1000' Describe/explain (Note streambank  
stability and condition of streambank vegetation and any manmade structures or channel changes present):  
Observed erosion of tailings by adit discharge; migrated in Badger  
Creek at least 1,000 feet.

# SURFACE WATER INVENTORY FORM

SAMPLERS: Babits, Flammang, Lasher

SAMPLE I.D. NO.	SAMPLE TYPE	DESCRIPTION OF SAMPLE LOCATION	pH SU	SC $\mu\text{S}/\text{cm}$ @ 25°C	Eh mV	Temp °C	ALK. mg/L as $\text{CaCO}_3$	Flow, cfs/gpm	LAB. SAMPLE NO.	DATE/TIME	ANALYSES
SW-1	SW	100' upgradient of tailings in Badger Creek	8.07	70	149	NM	18	1.25 cfs (M)	04-014-SW-1	07/27/93 1135	T-Metals, TDS, Hardness, Cl, SO <sub>4</sub> , NO <sub>2</sub> /NO <sub>3</sub> , CN-
SE-1	SE	100' upgradient of tailings in Badger Creek	N/A	N/A	N/A	N/A	N/A	N/A	04-014-SE-1	07/27/93 1135	T-Metals, CN-
SW-2	SW	At PPE of edit discharge and tailings in Badger Creek	7.72	80	160	NM	17	1.25 cfs (M)	04-014-SW-2	07/27/93 1100	T-Metals, TDS, Hardness, Cl, SO <sub>4</sub> , NO <sub>2</sub> /NO <sub>3</sub> , CN-
SE-2	SE	At PPE of edit discharge and tailings in Badger Creek	N/A	N/A	N/A	N/A	N/A	N/A	04-014-SE-2	07/27/93 1100	T-Metals, CN-
SW-3	SW	500' downgradient of SW-2 in Badger Creek	8.19	NM	159	NM	32	1.25 cfs (M)	N/A	N/A	Field Parameters
SE-3	SE	500' downgradient of SW-2 in Badger Creek	6.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	XRF Analysis
SW-4	SW	1000' downgradient of SW-2 in Badger Creek	7.52	NM	177	1.5	28	1.25 cfs (M)	N/A	N/A	Field Parameters
SE-4	SE	1000' downgradient of SW-2 in Badger Creek	6.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	XRF Analysis

FLOW: Estimated (E) or Measured (M) ?

Comments or Deviations from the SOPs (Pioneer SAP, 1993): NM = Not Measured

## D. ACID MINE DRAINAGE (AMD) POTENTIAL

Evaluate each source in table on next page.

### AMD Characteristics:

Presence and abundance of sulfides? (SO<sub>3</sub>)  
Presence of evaporative salt deposits? (ESD)  
Discolored or turbid seepage? (SPG)  
Presence of long filamentous algae in drainages, mosses in moist areas?  
Presence of ferric hydroxide precipitates? (FEOX)  
Presence of burned or stressed vegetation? (VEG)  
pH ≤ 5.0 (pH)

### General Potential for AMD Mitigation:

Area available for treatment (acres)? 1 acre

Wetlands present: Yes X, No    , Describe: Streamside

Carbonate rocks/soils: Yes X, No    , Describe: Carbonate precipitate

## E. AIR PATHWAY CHARACTERISTICS

Population within 4-mile radius: 1-10    ; 10-30 X; 30-100    ;  
100-300    ; 300-1,000    ; 1,000-3,000    ; 3,000-10,000    ; 10,000 or  
greater    ; Comments    

Nearest residence(ft or miles)? 0.5 mile

For each source (table next page):

Available fine materials? Surface area?

Uncovered and unvegetated? Wet or dry?

Overall dust propagation potential:  
observed high moderate low none



# ACID DRAINAGE/AIR PATHWAY INVENTORY FORM

SAMPLERS: Babits, Lasher

SOURCE I.D. NO.	ACID MINE DRAINAGE CHARACTERISTICS (LIST)	MOISTURE CONTENT (WET/DRY/PARTIAL)	SURFACE AREA (SQUARE FEET)	UNCOVERED/UNVEGETATED AREA (SQUARE FEET)	AVAILABLE FINES (YES/NO)	DUST PROPAGATION POTENTIAL (OBSERVED/HIGH /MODERATE/LOW/NONE)
WR-1	SO3	Wet	855	855	Yes	Moderate/High
WR-2	SO3	Wet	2,565	2,565	Yes	Moderate/High
WR-3	SO3	Wet	5,265	5,265	Yes	Moderate/High
WR-4	SO3	Wet	19,260	19,260	Yes	Moderate/High
WR-5	SO3; pH	Wet	19,530	19,530	Yes	Moderate/High
TP-1	None	Partial	27,000	27,000	Yes	Moderate/High
TP-2	None	Wet	33,300	24,975	Yes	Moderate/High

Notes and Clarifications:

## F. DIRECT CONTACT CHARACTERISTICS

Residents or workers within 200 feet of sources: Yes\_\_\_\_, No X,  
Describe: \_\_\_\_\_

Population within 1 mile: 1-10\_\_\_\_; 10-30 X; 30-100\_\_\_\_; 100-300\_\_\_\_;  
300-1,000\_\_\_\_; 1,000-3,000\_\_\_\_; 3,000-10,000\_\_\_\_; 10,000 or greater\_\_\_\_;  
Comments \_\_\_\_\_

Evidence of recreational use on site: Yes X, No\_\_\_\_, Describe: Gun  
shells

Accessibility - Fences, warning signs, closed roads? Unrestricted

Sensitive environments on-site or adjacent to site:

State or National Parks -	Yes____, No <u>X</u> , Comment _____
Wilderness Area -	Yes____, No <u>X</u> , Comment _____
T&E Species Habitat -	Yes____, No <u>X</u> , Comment _____
Bat Habitat -	Yes____, No <u>X</u> , Comment _____

Primary Drainage X; Secondary Drainage\_\_\_\_; No Information\_\_\_\_:

Riparian Habitat Quality - High X, Medium\_\_\_\_, Low\_\_\_\_  
Wetlands Frontage - High X, Medium\_\_\_\_, Low\_\_\_\_  
Fisheries Habitat and Species Classification - 4  
Sport Fishery Classification - 4

## G. SAFETY CHARACTERISTICS

Verify completeness of AMRB Inventory

Hazardous openings: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_

Hazardous structures: Yes\_\_\_\_, No X, Number\_\_\_\_, types and locations:\_\_\_\_

Unstable highwalls, pits, trenches, slopes: Yes\_\_\_\_, No X, Number\_\_\_\_,  
types and locations:\_\_\_\_

Unstable waste piles, impoundments, undercut banks: Yes\_\_\_\_, No X,  
Number\_\_\_\_, types and locations:\_\_\_\_

Fire and/or Explosion hazards: Yes\_\_\_\_, No X, Explain:\_\_\_\_



## Bibliography

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- MDSL/AMRB Files, Abandoned Mine Lands National Inventory, Phase II Problem Area Data Sheet for Vosburg Mine, Prepared by Tierra Buena Contracting, December 20, 1982.
- MDSL/AMRB Files, Abandoned Mine Reclamation Inventory Field Form for Vosburg, Prepared by Northern Engineering and Testing, May 23, 1988.
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- USGS, Geology and Mineral Deposits, East Flank of the Elkhorn Mountains, Broadwater County, Montana, Professional Paper 665, Author Unknown, Date Unknown.
- USGS, Topographic Map, Winston, Montana, 7 1/2 minute Quadrangle, 1986.



LABORATORY ANALYTICAL DATA

VOSBURG  
PA NO. 04-014



Vosburg PA# 04-014  
AMFB HAZARDOUS MATERIALS INVENTORY  
INVESTIGATOR: PIONEER - BABITS  
INVESTIGATION DATE: 07/27/93

SOLID MATRIX ANALYSES

Results per dry weight basis

FIELD ID	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Co (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Mn (mg/kg)	Ni (mg/kg)	Pb (mg/kg)	Sb (mg/kg)	Zn (mg/kg)	CYANIDE (mg/kg)
04-014-SE-1	60	65.3	1.3	3.7	7.4	17.5	10400	0.038 J	392	5 J	47	8 U	87	0.436 U
04-014-SE-2	8860	76.8	5.4	3.4	10.3	564	54400	0.102 J	1600	3 U	3590	13 J	332	1.1
04-014-TP-1	13100	95	7.8	6.2	16.6	780	78600	0.256 J	2080	4 J	4640	12 J	564	8.38
04-014-WR-1	2030	131	8.4	7.9	1.5	273	30500	1.64 J	3860	3 U	737	6 U	596	NR
04-014-WR-2	204	33.1	0.6	2.4	1.3 U	38.2	8670	1.41 J	598	2 U	86	6 U	63	NR
04-014-WR-3	3990	175	5.9	5.6	1.3 U	379	32800	1.56 J	2030	2 U	729	6 U	318	NR
BACKGROUND	85	63.2	0.7	1.9 U	1.9	11.6	9000	0.011 J	470	3 U	77	6 U	74	NR

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Acid/Base Accounting

FIELD ID	TOTAL SULFUR %	TOTAL ACID BASE 1/1000t	NEUTRAL POTENT. 1/1000t	SULFUR ACID BASE 1/1000t	SULFATE SULFUR %	PYRITIC SULFUR %	ORGANIC SULFUR %	PYRITIC ACID BASE 1/1000t	SULFUR ACID BASE POTENT. 1/1000t
04-014-TP-1	0.35	10.9	15.8	4.89	0.33	<0.01	0.02	0.00	15.8
04-014-WR-1	0.04	1.25	6.97	5.72	0.03	<0.01	0.01	0.00	6.97
04-014-WR-2	0.04	1.25	12.8	11.6	0.01	<0.01	0.03	0.00	12.8
04-014-WR-3	0.65	20.3	6.38	-13.9	0.41	0.09	0.15	2.81	3.57

WATER MATRIX ANALYSES

Results in ug/L

FIELD ID	As	Ba	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Sb	Zn (mg CaCO3/L)	HARDNESS CALC.
04-014-SW-1	2.67	2.01 U	2.57 U	9.7 U	6.83 U	1.55 U	123	0.038 U	4.08 U	12.7 U	4.64	30.7 U	7.57 U	21.5
04-014-SW-2	295	4.67	2.57 U	9.7 U	6.83 U	14.9	1300	0.038	61.6 J	12.7 U	35.3	30.7 U	27.1	25.5
04-014-SW-5	268	2.01 U	2.57 U	9.7 U	6.83 U	1.55 U	409	0.087	5.5 J	12.7 U	2.95	30.7 U	7.57 U	43

U - Not Detected; J - Estimated Quantity; X - Outlier for Accuracy or Precision; NR - Not Requested

Wet Chemistry

Results in mg/l

FIELD ID	TOTAL DISSOLVED SOLIDS	CHLORIDE	SULFATE	NO3/NO2-N	CYANIDE
04-014-SW-1	108 <	5.0	6 <	0.05 <	0.00
04-014-SW-2	127 <	5.0	8 <	0.05 <	0.00
04-014-SW-5	122 <	5.0	12	1.3	NR

LEGEND

- SE1 - 100 feet upgradient of tailings in Budget Creek.  
SE2 - At PPE of adit discharge and tailings in Budget Creek.  
TP1 - Composite of subsamples TP1A, 1B, and TP2A-A.  
WR1 - Composite of subsamples WR1A, 2A, and 2B.  
WR2 - Composite of subsamples WR2A and B.  
WR3 - Composite of subsamples WR3A, 4B, 5A, 5B, 5C, and 5D.  
BACKGROUND - From Vosburg (04-014-SS1).
- SW1 - Same as SE1.  
SW2 - Same as SE2.  
SW5 - Adit discharge of waste rock dump 5.





XRF ANALYSIS RESULTS

VOSBURG  
PA NO. 04-014



XRF SAMPLE ID	CHI	K	Ca	Ti	CrLO	Mn	Fe	Co	Cu	Zn	As	Sr
04-014-SE-3		16874.5	4995.83	767.719		1772.55	62138.4	440.008 *	374.507	241.866	8755.65	281.807
04-014-SE-4		16592.2	5348.86	726.489		1779.85	59310.8		347.943	302.955	8245.58	346.164
04-014-SS-1		19492.8	10004.6	2240.4		539.429 *	16348.9			87.1073 *	55.6765 *	765.699
04-014-TP1-A		33225.7	12301.8	845.556		1987.58	76127.3		661.832	438.574	13138.9	301.12
04-014-TP1-B		32038.5	7240.26	639.33		2380.25	70572		473.691	441.59	10496	379.975
04-014-TP2A-A		24885.8	6299.03	601.519		1740.4	55901.1		400.818	401.902	8612.77	276.005
04-014-TP2A-B		31430.1	9899.15	380.578 *		2846.09	91334.9		658.679	784.404	14938.5	250.784
04-014-TP2B-A		30162.3	9271.91	400.384 *		2822.9	89299.7		614.085	685.228	14835.6	239.93
04-014-TP-1-COMP		31474.8	8968.44	567.065		2506.94	86275.5		553.291	631.547	13572.5	272.912
04-014-WR2-A		23263.3	8346.42	828.429		1177.27 *	47212.2		361.112	331.743	2066.25	511.279
04-014-WR2-B		31460.6	6675.28	481.753		5588.34	44911.4		206.476 *	625.042	2505.75	437.057
04-014-WR3-A		23984.8	17387	751.82		758.48 *	12719.7					1237.26
04-014-WR3-B		25706.2	15549.6	667.647		1200.14	18941.9					1026.67
04-014-WR4-A		30003.2	5140.69	367.782 *		2548.41	50399.9	424.871 *				301.597
04-014-WR4-B		21558.6	8790.15	687.067		2507.91	37100.7		327.278	541.323	1691.8	570.49
04-014-WR5-A		38168.4	4583	503.999		3283.94	81960.3		164.111 *	139.693 *	4918.27	193.434
04-014-WR5-B		44059	5387.73	449.293		4167.66 *	37160.5		217.015	190.07	4229.27	230.364
04-014-WR5-C		39951.4	8785.76	531.489		1050.87	47610		280.937	846.624	3267.89	406.278
04-014-WR5-D		24198	17076.8	412.579 *		6398.52	44560.4		241.181	557.462	2511.36	591.868
04-014-WR-1		21824.1	9791.96	2048.45		2091.3	31911.3		211.083	300.837	1033.45	750.814
04-014-WR-1-COMP		24918	8676.76	1167.67		2831.01	40502.6		224.89	447.657	1550.24	611.385
04-014-WR-2-COMP		20496.2	13481.1	567.452		828.642 *	11517.8			46.0513 *	62.7101 *	1097.57
04-014-WR-3-COMP		27601.6	8374.59	479.493		3404.98	46308		259.324	376.257	3265.38	366.378
Zr	Hg	Mo	Pb	Rb	Cd	Sb	Ba	Ag	U	Th		
04-014-SE-3	99.5144		2121.84	137.7	210.992 *		480.927	167.579 *	14.6831 *			
04-014-SE-4	116.276		2010.94	128.617	183.499 *		459.834	167.673 *	14.0958 *			
04-014-SS-1	196.596		67.78	158.256	138.958 *		1581.35		18.5534 *	11.6302 *		
04-014-TP1-A	93.2845	7.91118 *	4877.74	202.012	293.19 *		522.188	142.116 *	15.1892 *	23.073 *		
04-014-TP1-B	110.891		1625.5	214.251			732.616	175.53 *	15.151 *			
04-014-TP2A-A	118.846		1782.51	169.77	147.194 *		524.339	100.809 *	20.038 *			
04-014-TP2A-B	73.9981	10.1043 *	3784.98	225.021	202.636 *		401.569	132.757 *	23.0937 *			
04-014-TP2B-A	72.2103	10.6794 *	3722.29	210.54			332.377	206.796 *	15.0305 *			
04-014-TP-1-COMP	85.7794	7.36843 *	3536.03	199.943			567.784	144.74 *	21.2533 *	16.3317 *		
04-014-WR2-A	150.262		463.565	192.89	165.829 *		930.779	128.123 *	22.4027 *	18.7332 *		
04-014-WR2-B	124.344		497.017	256.215	142.152 *		929.236	95.2904 *	38.1652 *	9.24281 *		
04-014-WR3-A	133.985			144.344	144.18 *		1998.14			12.0156 *		
04-014-WR3-B	144.523		148.45	137.875			1550.8	80.9772 *		11.9058 *		
04-014-WR4-A	123.855		906.816	245.952	161.223		872.088		24.4034 *			
04-014-WR4-B	149.026	40.7552 *	211.612	197.908	126.463 *		1354.79	80.5881 *	16.026 *			
04-014-WR5-A	121.109		617.236	303.87	205.613 *		343.021	143.304 *				
04-014-WR5-B	140.791		1506.86	300.709	235.614 *		514.91	175.253 *	20.1119 *			
04-014-WR5-C	121.651		784.451	290.547	240.4 *		994.909		19.9323 *			
04-014-WR5-D	112.957		675.825	205.427			1292.55	91.6663 *				
04-014-WR-1	192.463		520.256	143.635	154.761 *		1444.7	81.3002 *	16.0634 *	17.6643 *		
04-014-WR-1-COMP	147.16		414.842	210.612	183.3 *		2190.76		18.3752 *			
04-014-WR-2-COMP	127.199		22.6392 *	134.367			1856.59		17.3783 *			
04-014-WR-3-COMP	137.988		499.771	216.278	213.902 *		808.521	112.201 *	17.9217 *			

\* - Estimated Quantity

\$ - Unvalidated Data



ABANDONED AND INACTIVE MINES SCORING SYSTEM (AIMSS)  
SCORESHEET

VOSBURG  
PA NO. 04-014





# **AIMSS SCORESHEET**

SITE NAME:  
PA NUMBER:

VOSBURG  
04-014

LINE NO.				
<b>GROUNDWATER PATHWAY</b>				
1		OBSERVED RELEASE		0
2		EXCEEDENCES		0
3A	GW - LIKELIHOOD OF RELEASE	CONTAINMENT		20
3B		GW DEPTH		20
3C		POTENTIAL TO RELEASE	LINES 3A x 3B	400
4		LIKELIHOOD SCORE	LINES 1 + 2 + 3C	400
5	GW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	577.984
6		WELLS - 1 MI. x 2.5		2.5
7	GW - TARGETS	WELLS - 1 TO 4 MI		73
8		NEAREST WELL		0
9		TARGETS SCORE	LINES 6 + 7 + 8	75.5
10		<b>GROUNDWATER SCORE</b>	LINES 4 x 5 x 9	17455117
<b>SURFACE WATER PATHWAY</b>				
11		OBSERVED RELEASE		300
12	SW - LIKELIHOOD OF RELEASE	EXCEEDENCES		100
13A		CONTAINMENT		20
13B		DISTANCE TO SW		20
13C		POTENTIAL TO RELEASE	LINES 13A x 13B	400
14		LIKELIHOOD SCORE	LINES 11 + 12 + 13C	800
15	SW - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	595.576
16		DRINKING WATER POP'N		0
17		IMPACTED DRAINAGE		1
18	SW - TARGETS	WETLANDS		10
19		FISHERY		1
20		RECREATION		5
21		IRRIGATION/STOCK		2
22		T & E SPECIES HABITAT		0
23		TARGETS SCORE	SUM LINES 16 - 22	19
24		<b>SURFACE WATER SCORE</b>	LINES 14 x 15 x 23	9052755
<b>AIR PATHWAY</b>				
25		OBSERVED RELEASE		0
26A	AIR - LIKELIHOOD OF RELEASE	CONTAINMENT		20
26B		DISTANCE TO POPULATION		10
26C		POTENTIAL TO RELEASE	LINES 26A x 26B	200
27		LIKELIHOOD SCORE	LINES 25 + 26C	200
28	AIR - WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	2.310
29		POPULATION - 4 MILES		10
30		NEAREST RESIDENCE		5
31	AIR - TARGETS	WETLANDS		10
32		PARKS / WILDERNESS		0
33		T & E SPECIES HABITAT		0
34		TARGETS SCORE	SUM LINES 29 - 33	25
35		<b>AIR PATHWAY SCORE</b>	LINES 27 x 28 x 34	11550
<b>DIRECT CONTACT PATHWAY</b>				
36		OBSERVED EXPOSURE		50
37A	LIKELIHOOD OF EXPOSURE	ACCESSIBILITY		20
37B		DISTANCE TO POPULATION		10
37C		POTENTIAL EXPOSURE	LINES 37A x 37B	200
38		LIKELIHOOD SCORE	LINES 36 + 37C	250
39	D. C. WASTE CHAR.	CALCULATED SCORE	(SEE WORKSHEET)	2.245
40	DIRECT CONTACT TARGETS	POPULATION - 1 MILE		10
41		NEAREST RESIDENCE		5
42		RECREATIONAL USE		5
43		TARGETS SCORE	SUM LINES 40 - 42	20
44		<b>DIRECT CONTACT SCORE</b>	LINES 38 x 39 x 43	11225
45	<b>TOTAL SITE HUMAN &amp; ENVIRONMENTAL HAZARD SCORE</b>			
	(LINES 10 + 24 + 35 + 44) / 100,000			265.31

LINE  
NO.

SITE NAME:  
PA NUMBER:

VOSBURG  
04-014

**SITE SAFETY**

1	THREAT	ACCESSIBILITY		20
2		OPEN SHAFTS	100 EA.	0
3		OPEN ADITS	50 EA.	0
4	HAZARDS	UNSTAB. HIWALLS / PITS	75 EA.	0
5		HAZ. STRUCTURES	40 EA.	0
6		EXPLOSIVES		0
7		HAZ. MATERIALS		0
8		HAZARDS SCORE	SUM LINES 2 - 7	0
9	TARGETS	POPULATION - 1 MILE		10
10		NEAREST RESIDENCE		5
11		RECREATIONAL USE		5
12		TARGETS SCORE	SUM LINES 9 - 11	20
13		SITE SAFETY SCORE	(LINES 1 x 8 x 12) / 1,000	0.00





04-014, #18: WR-5 and tailings pile



04-014, #19: WR-3

